

AD A-134 914

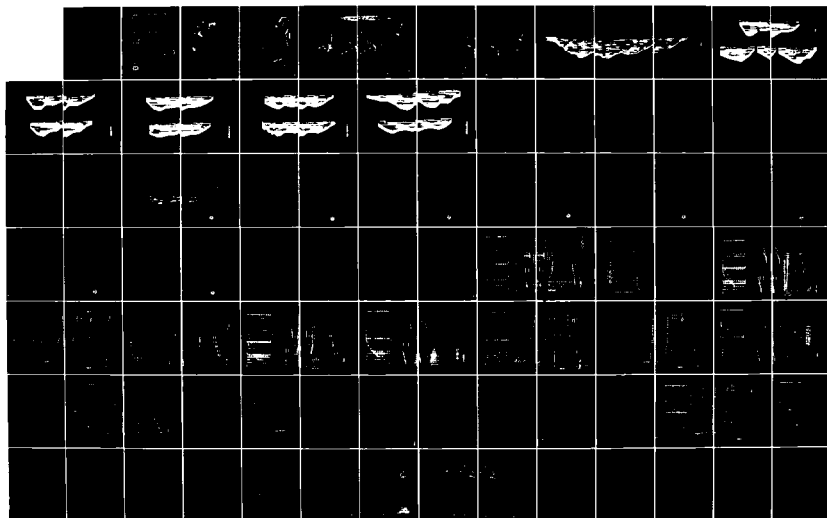
CONSTRUCTION FOUNDATION REPORT MISSOURI RIVER FORT PECK
MONTANA VOLUME 2 DRAWINGS(U) ARMY ENGINEER DISTRICT
OMAHA NE JAN 83

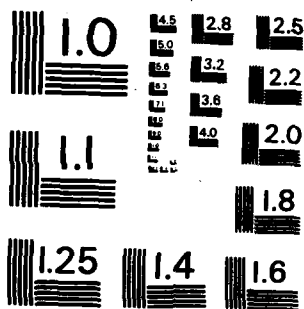
1/4

UNCLASSIFIED

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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

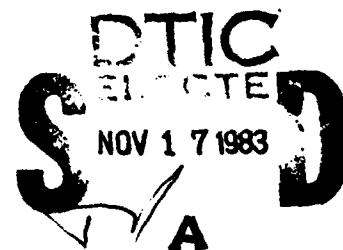
CONSTRUCTION FOUNDATION REPORT

(3)

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MISSOURI RIVER
FORT PECK LAKE, MONTANA

VOLUME II
DRAWINGS



DTIC FILE COPY

JANUARY 1983

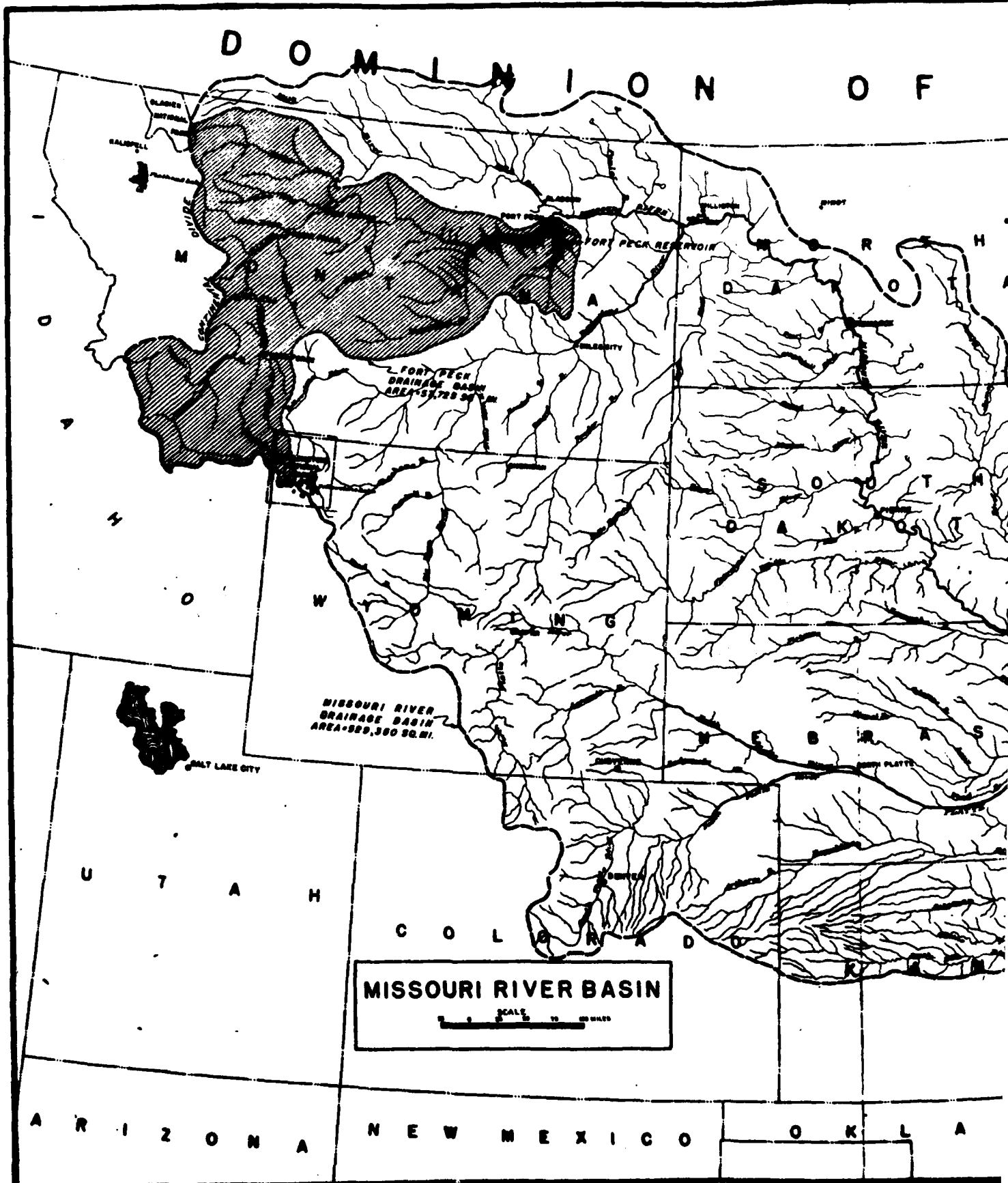


US Army Corps
of Engineers

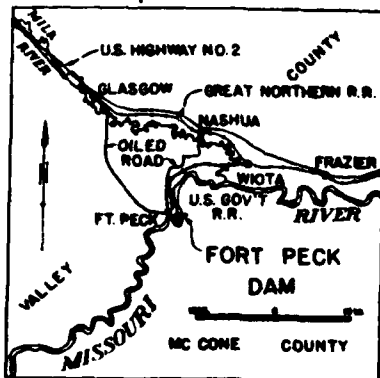
→ Omaha District

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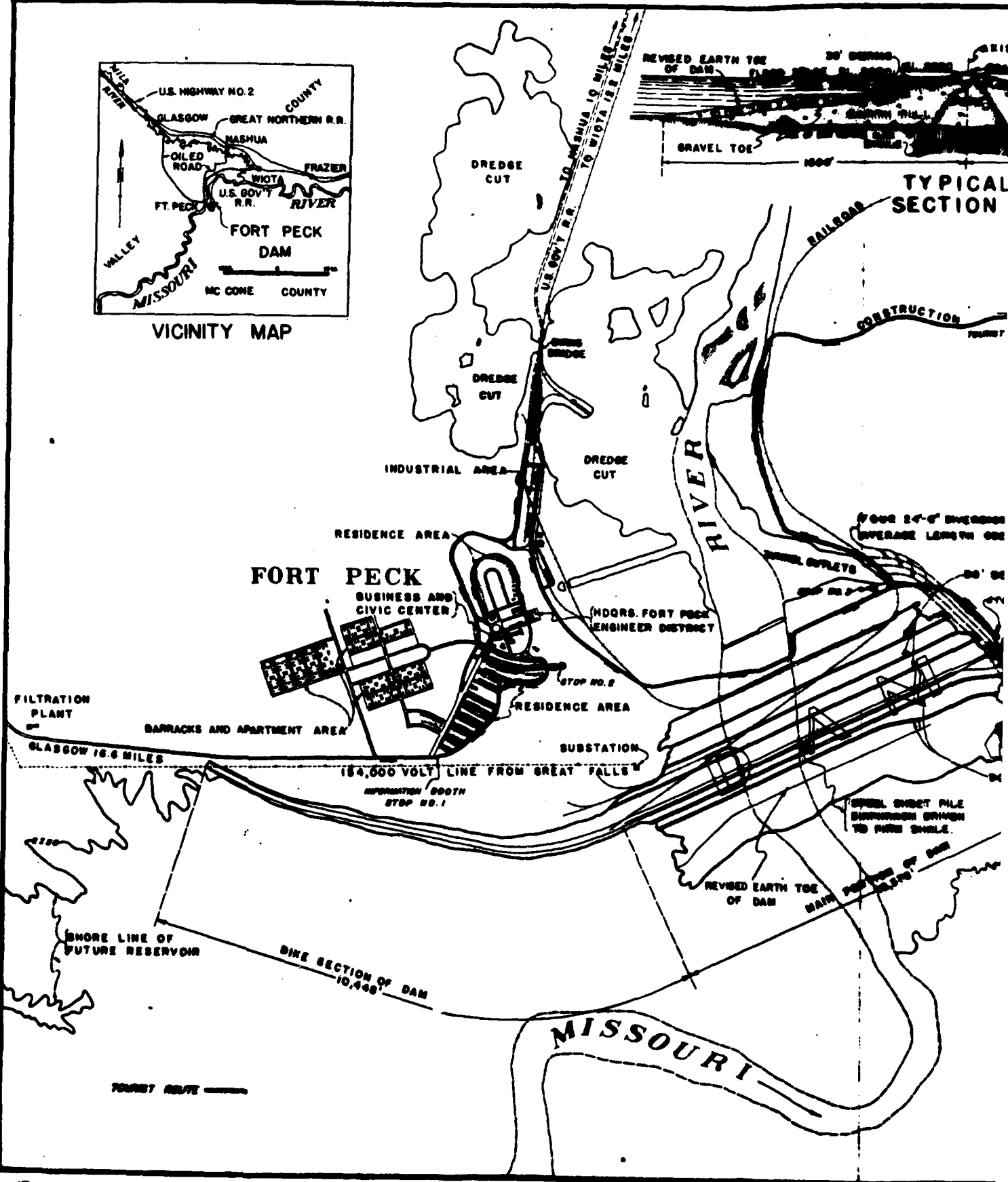
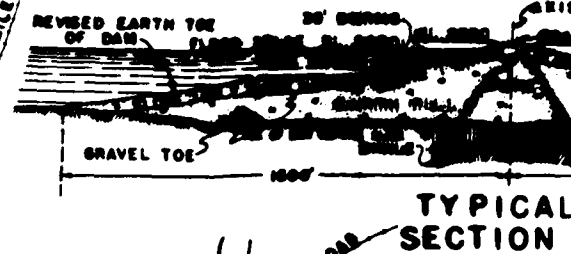
83 11 15 064

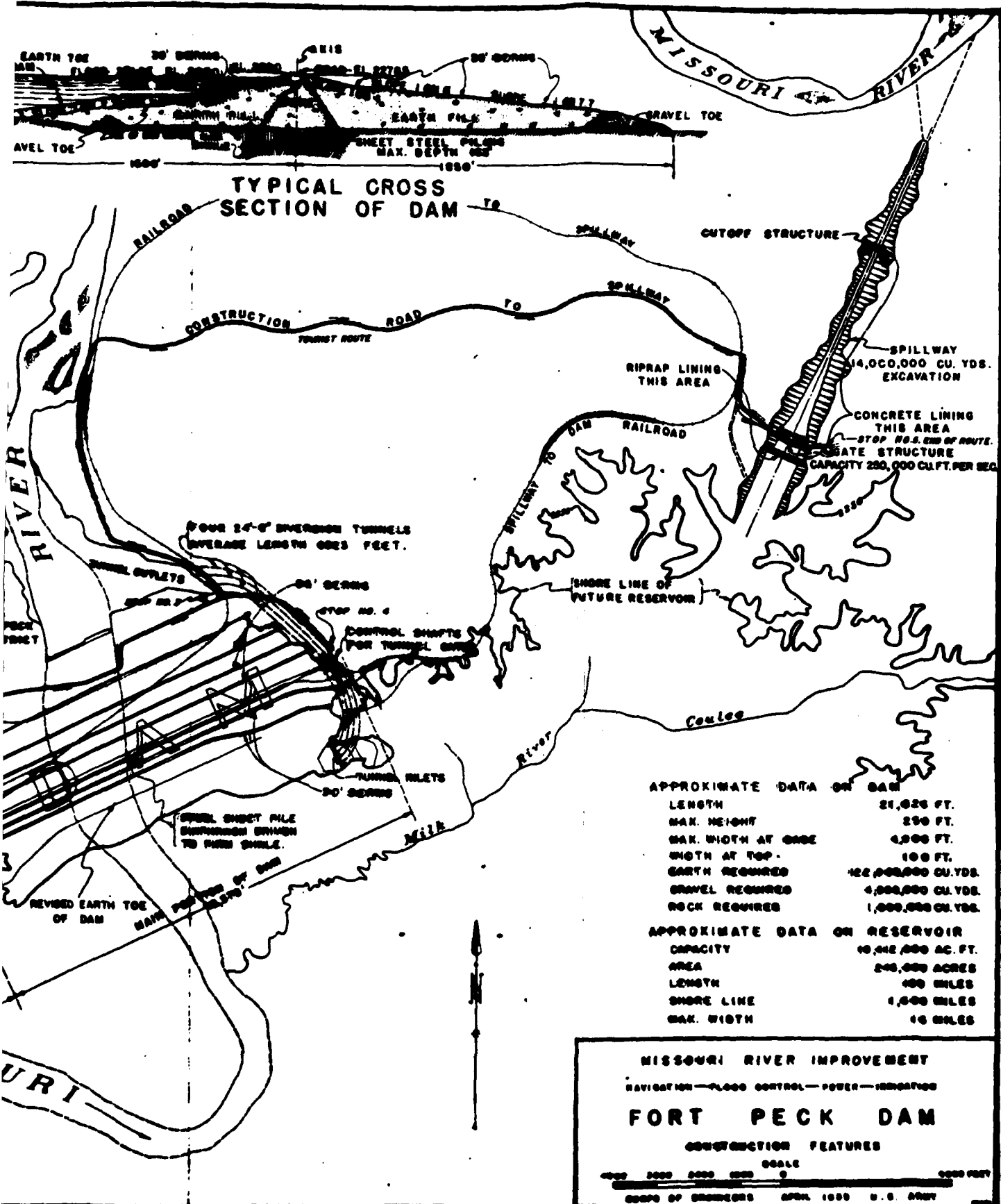


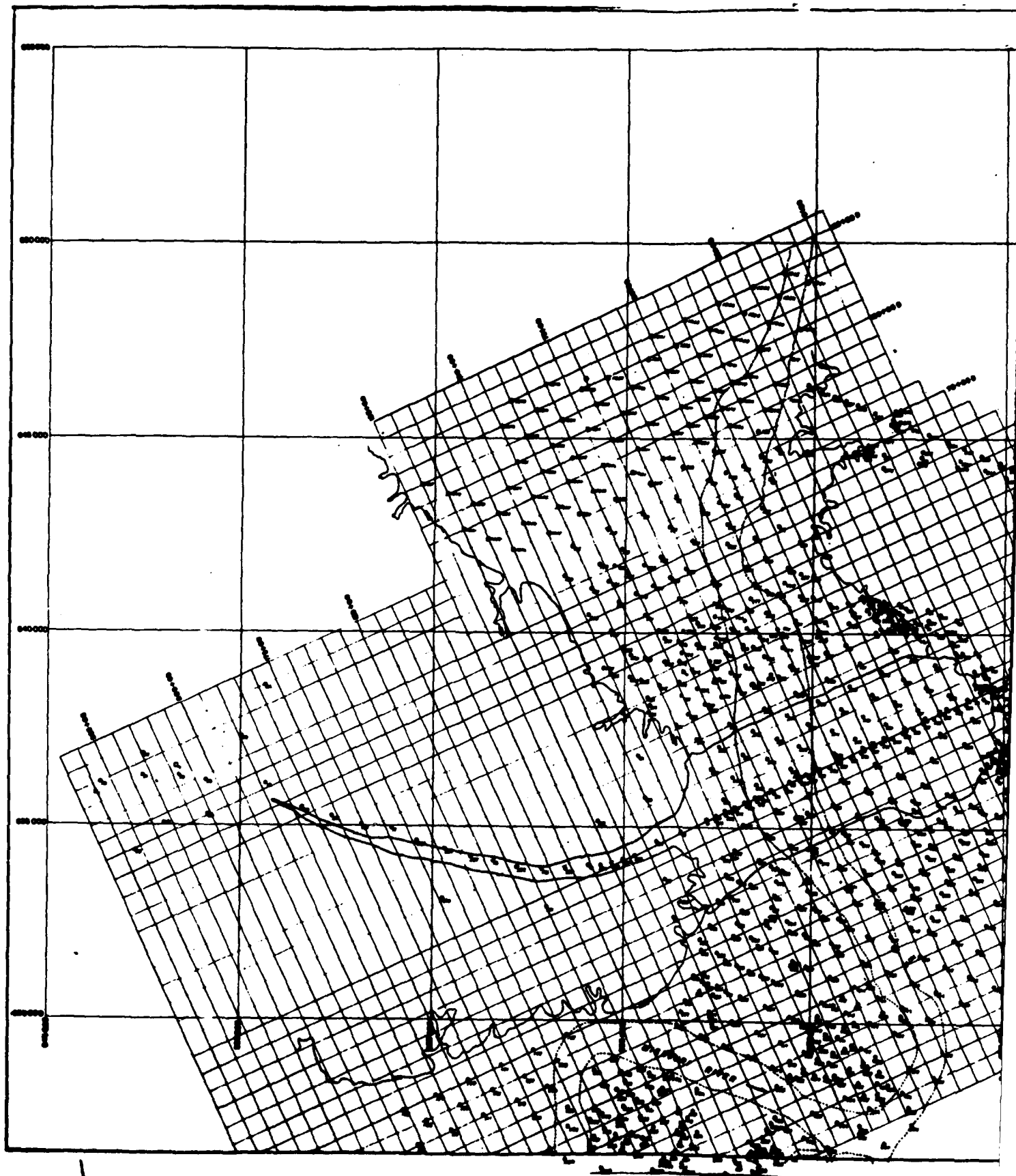


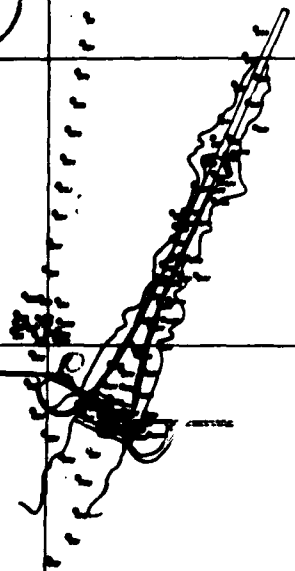
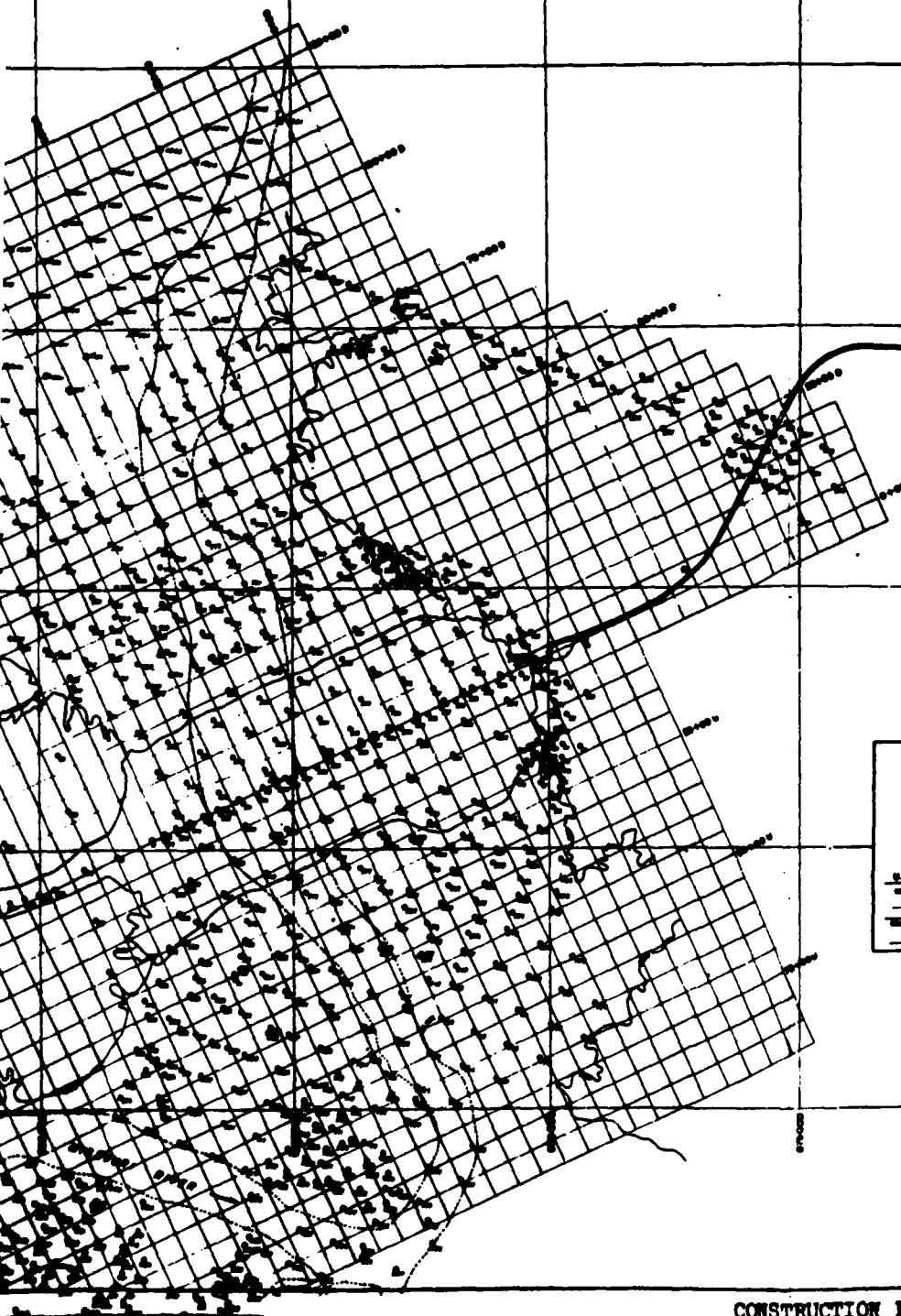


VICINITY MAP









Accession For
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A-1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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MISSOURI RIVER IMPROVEMENT
 OPERATION - FLOOD CONTROL - POWER - IRRIGATION

FORT PECK DAM
 INDEX TO CORE HOLES

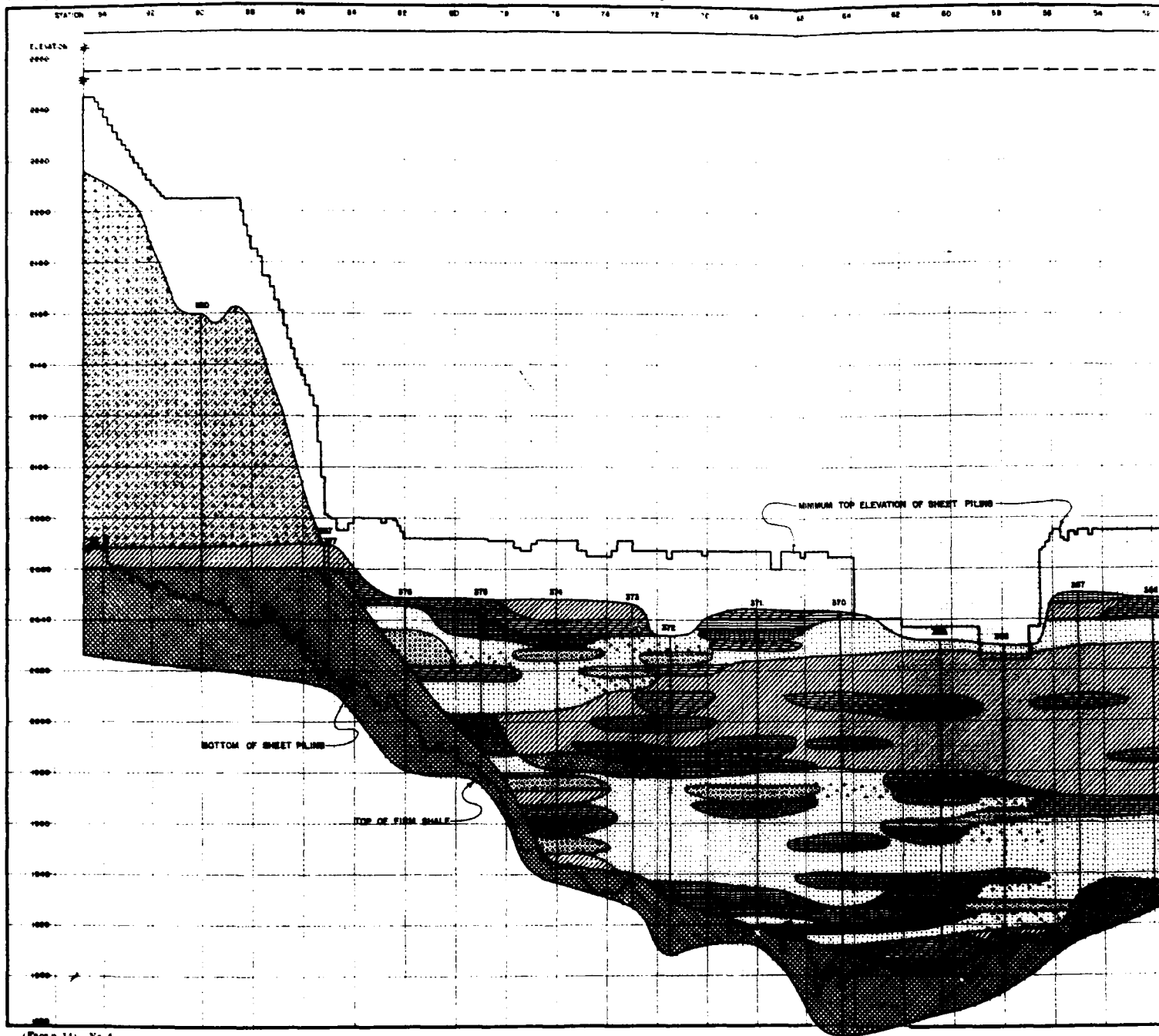
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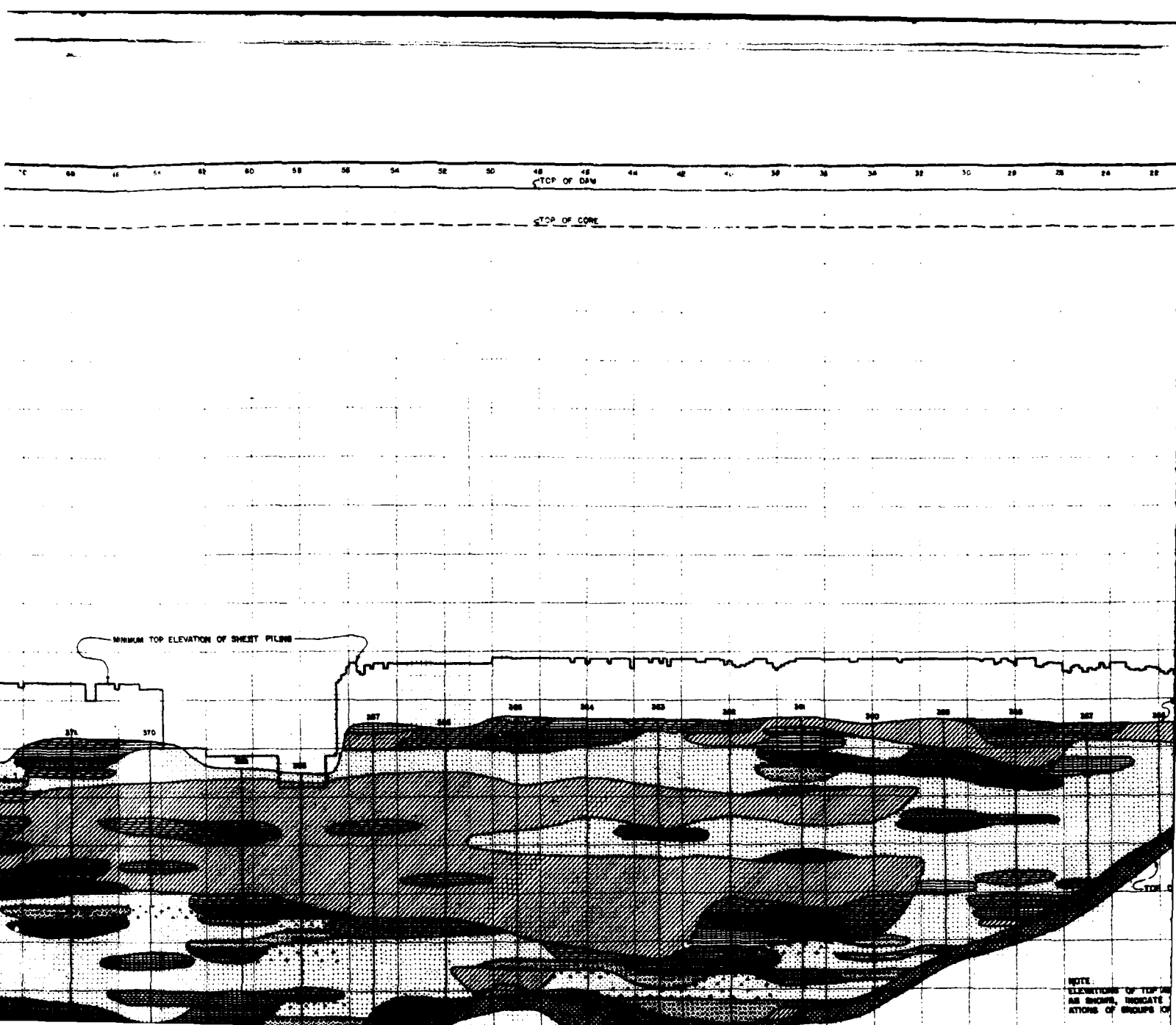
U.S. ENGINEERING OFFICE, BISMARCK, MONTANA

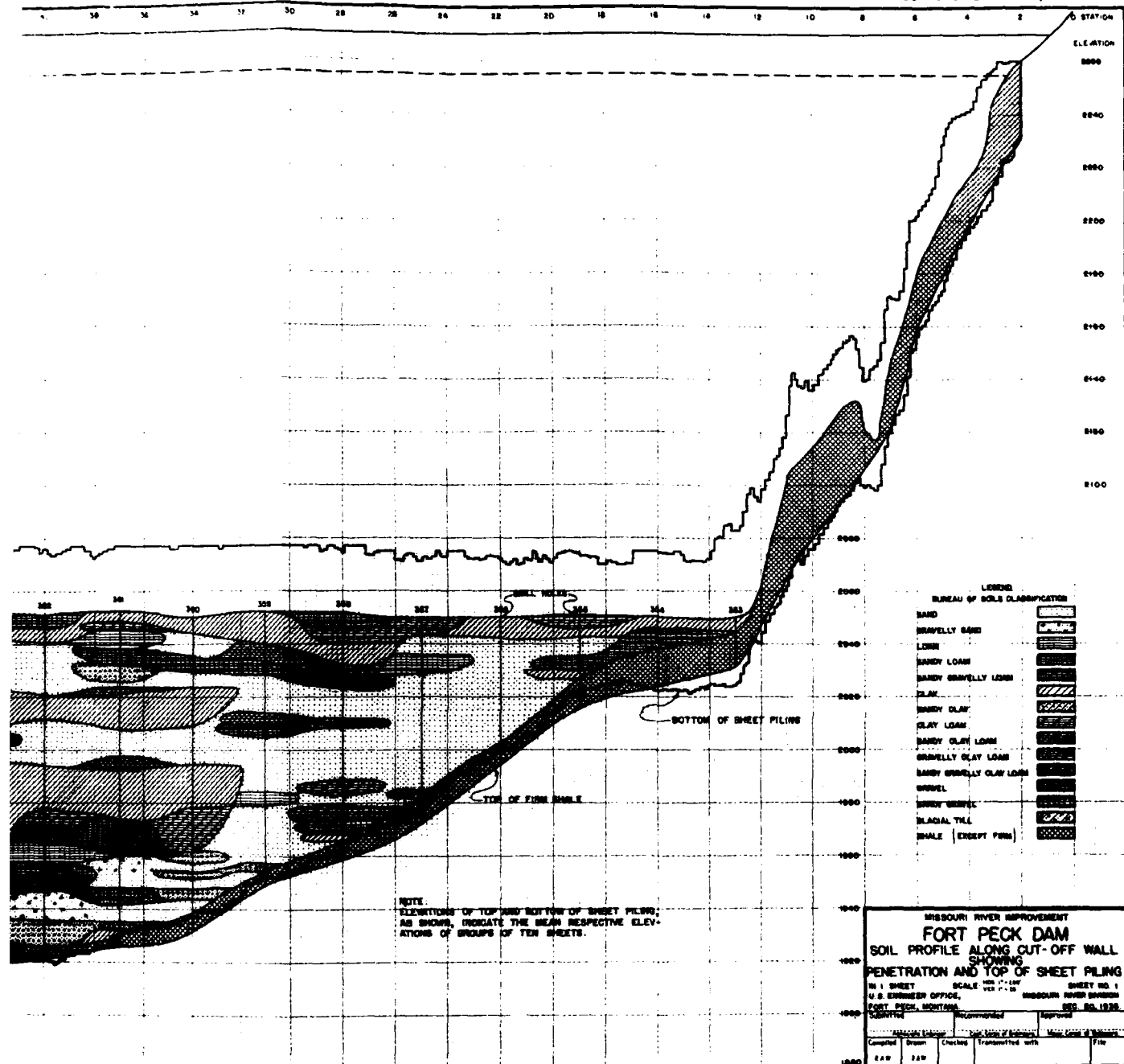
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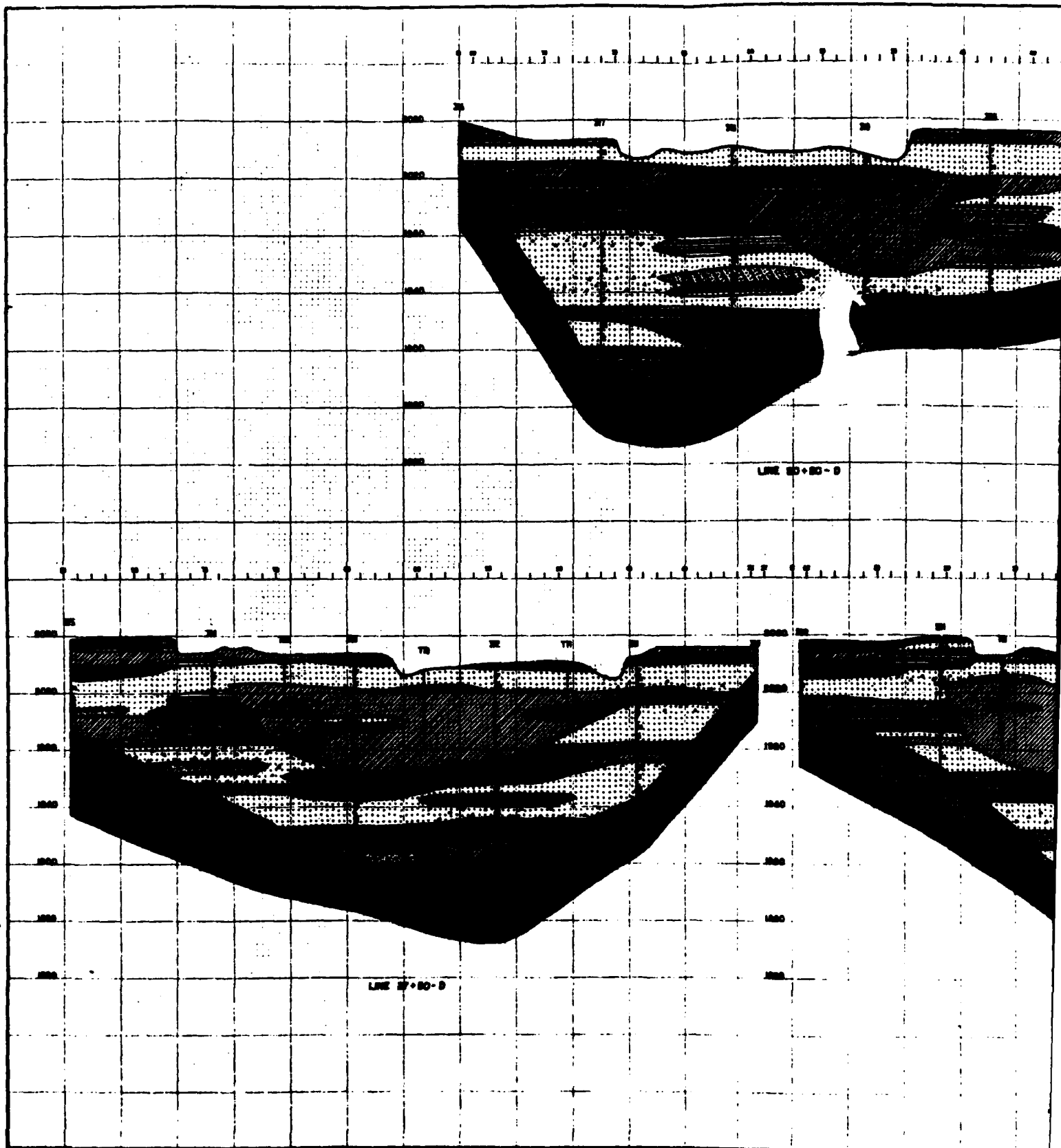
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63-2

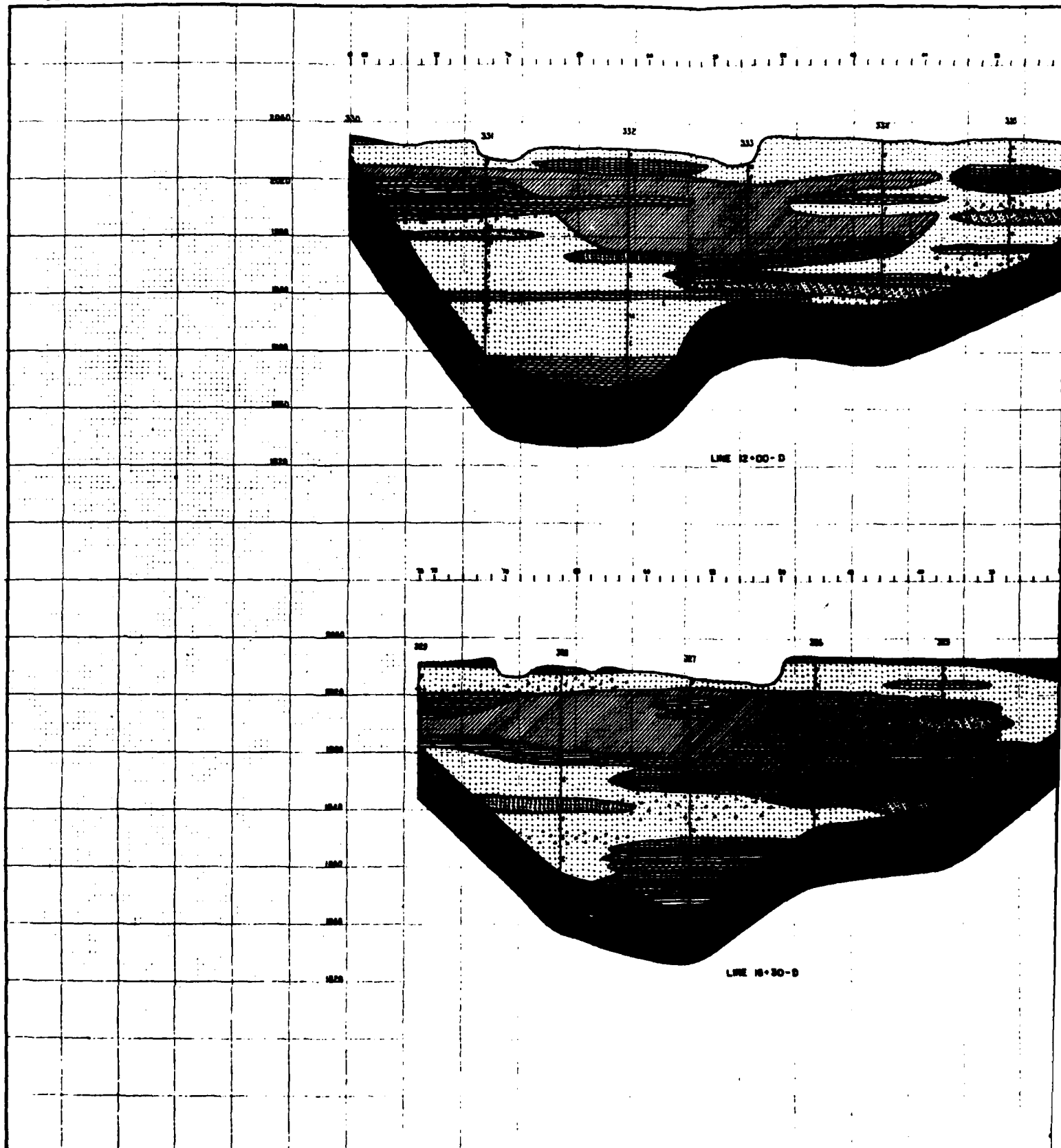


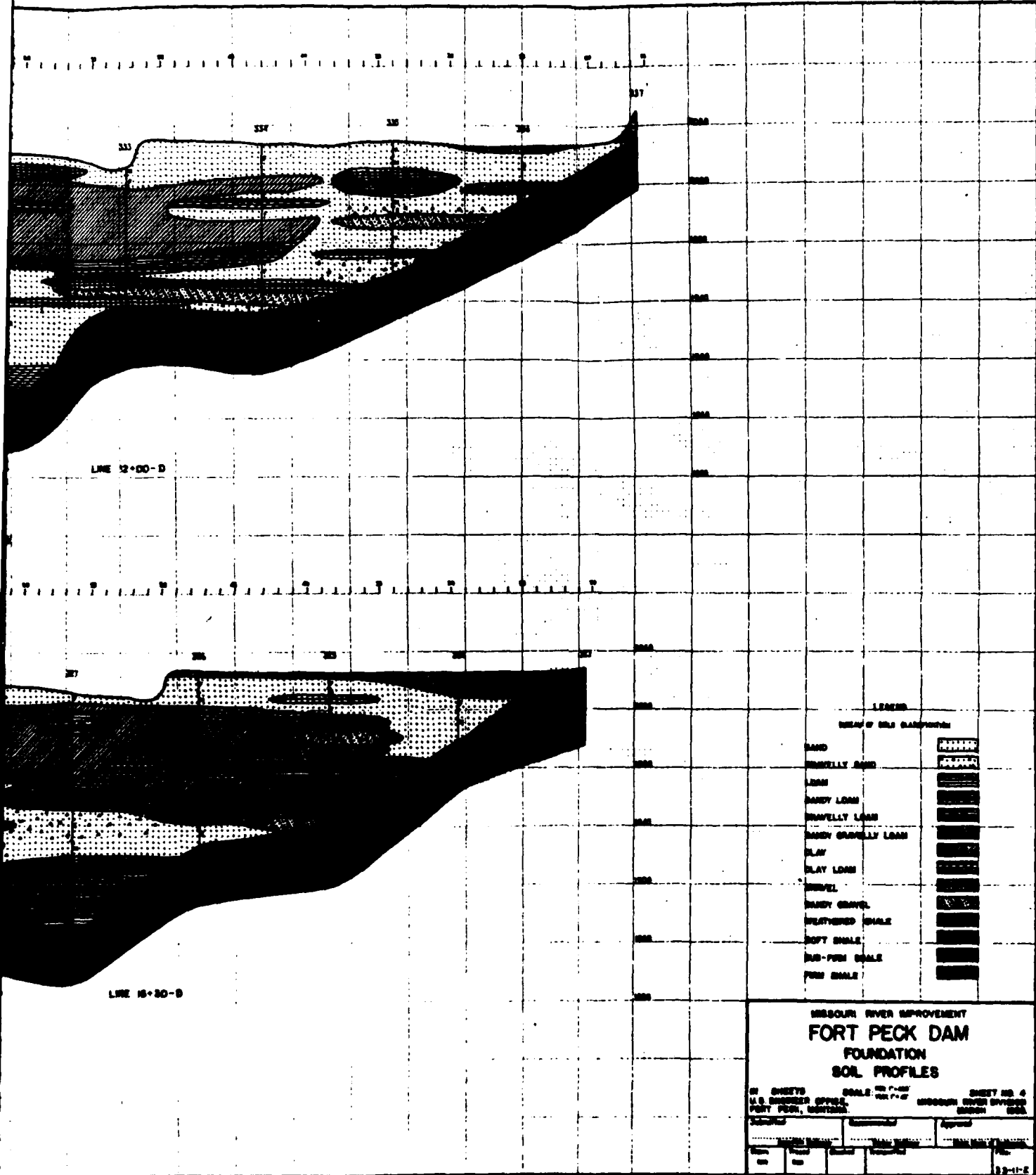




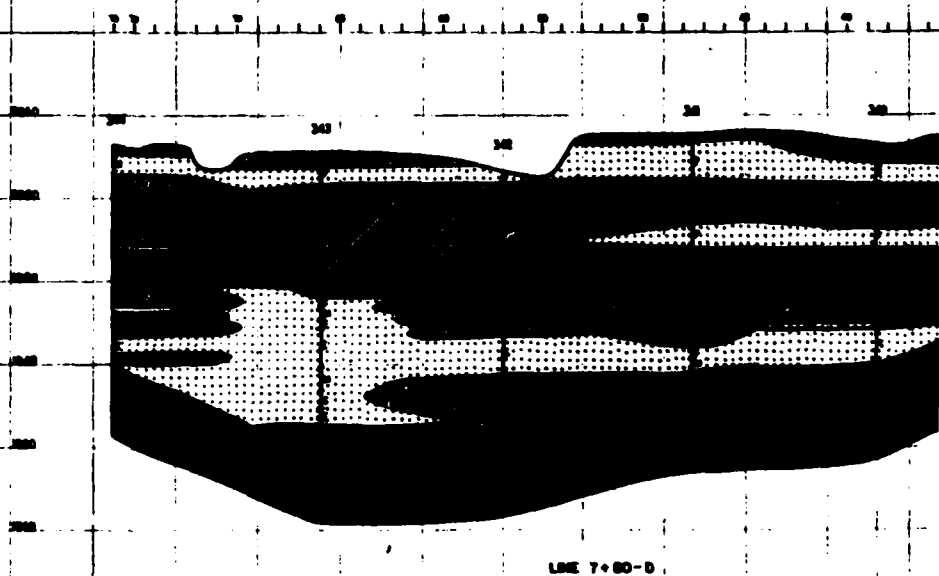
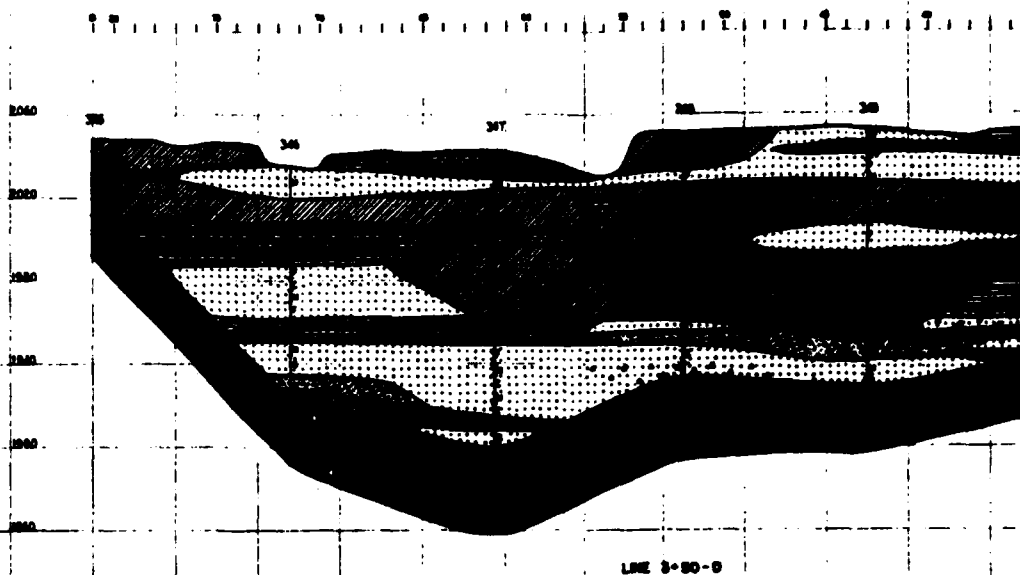


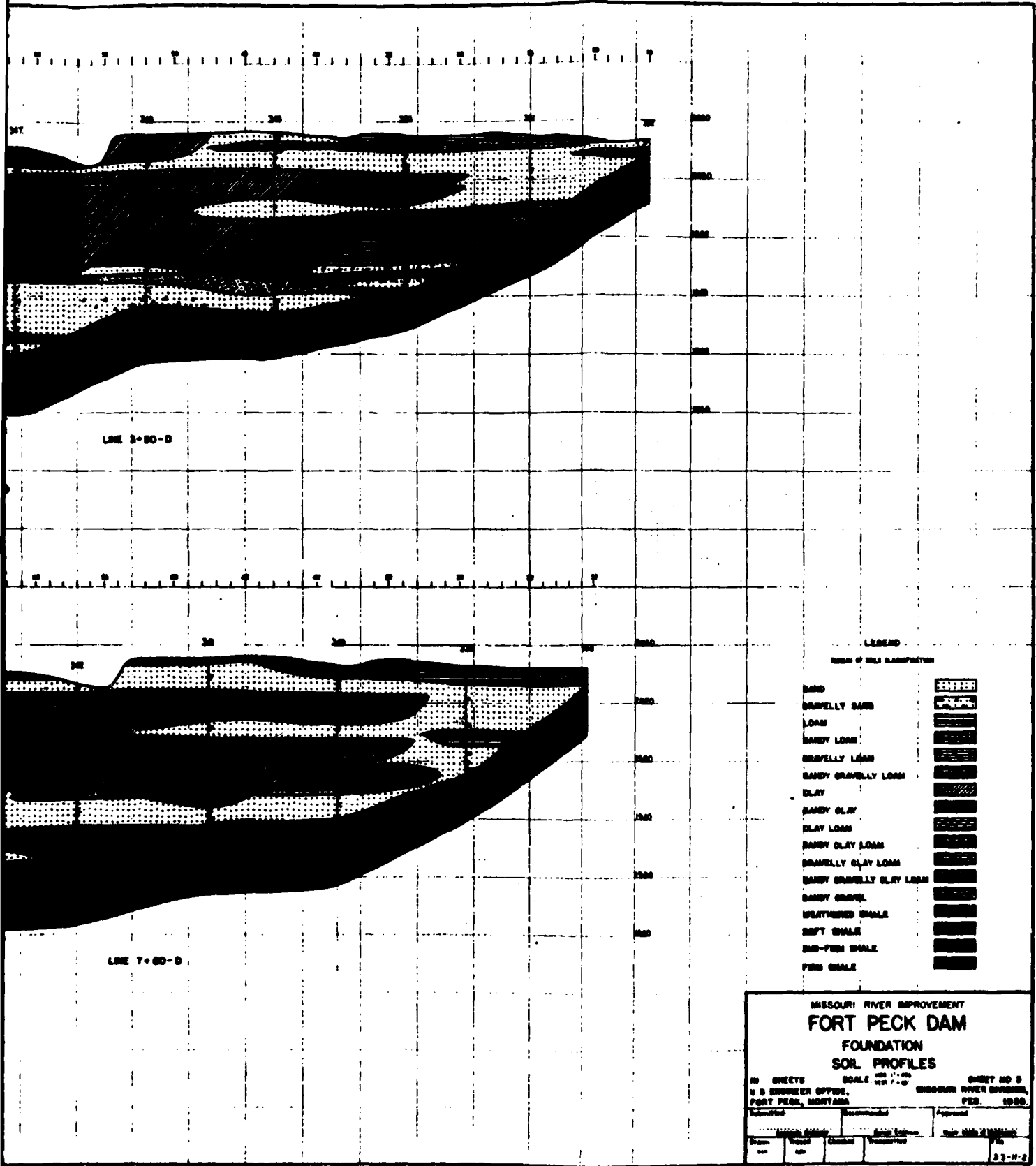
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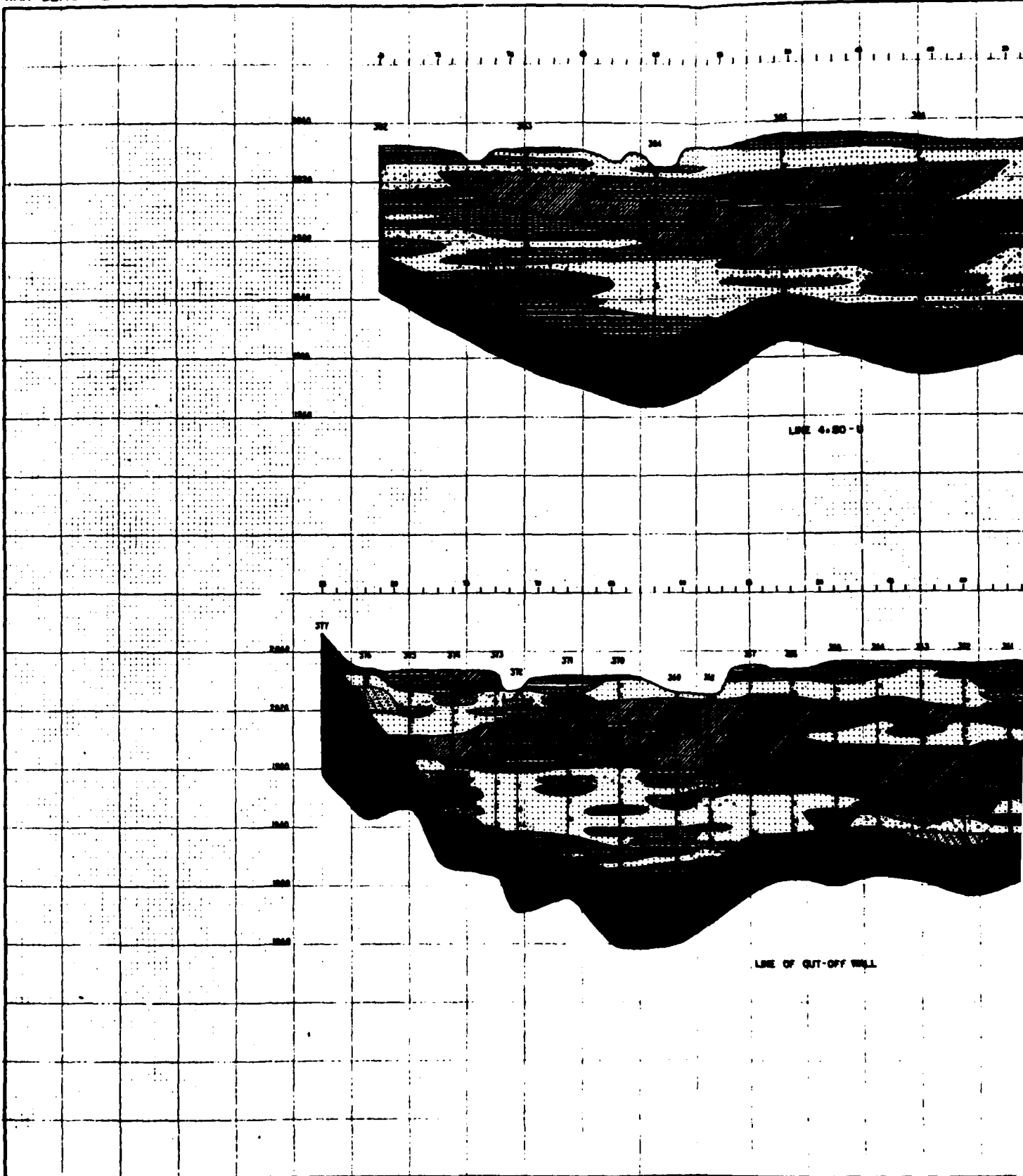
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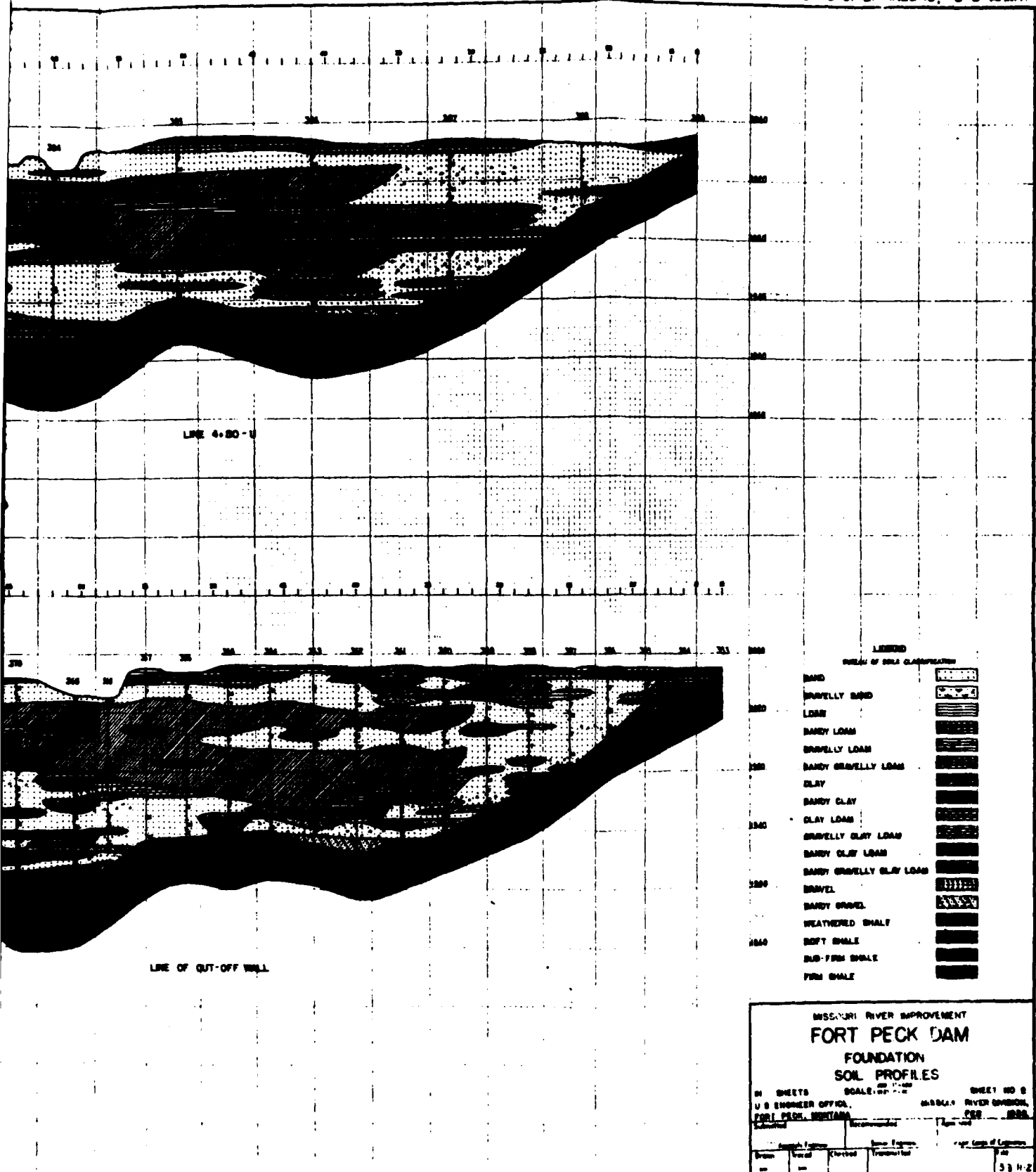




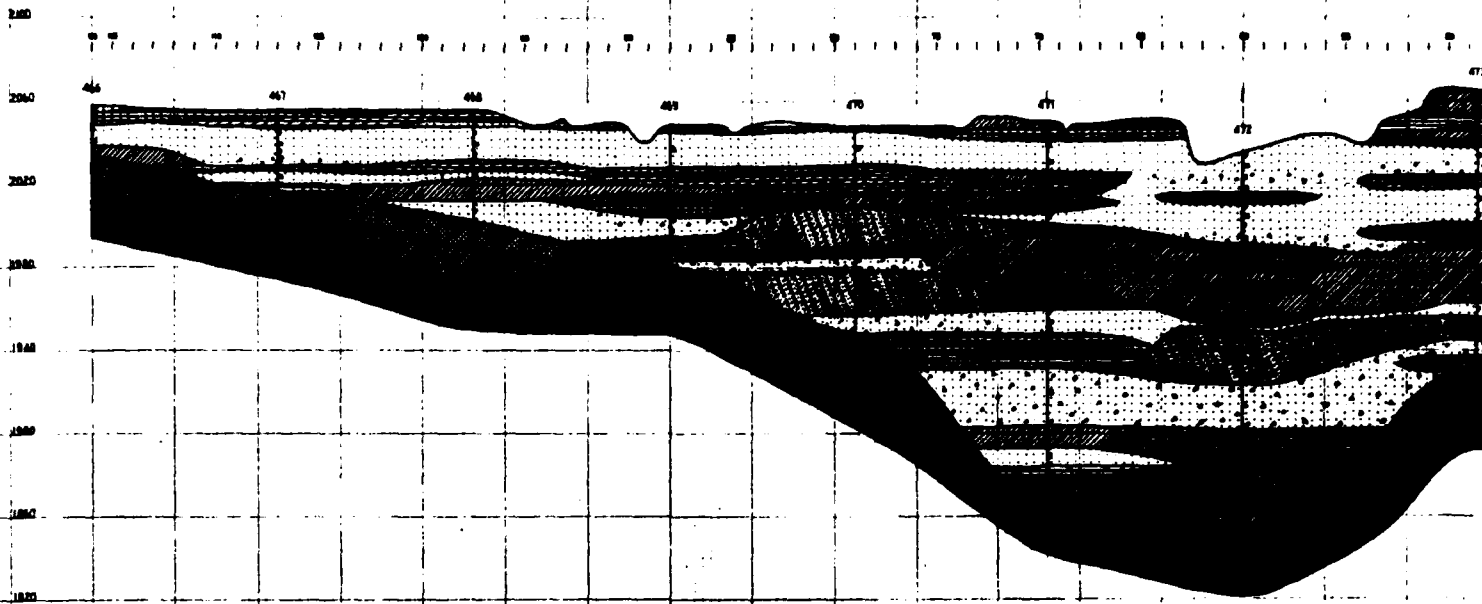
MISSOURI RIVER IMPROVEMENT			
FORT PECK DAM			
FOUNDATION			
SOIL PROFILES			
NO. SHEETS	SCALE	SHEET NO. 3	
U S ENGINEER OFFICE,	MISSOURI RIVER DIVISION,	FEB 1933	
FORT PECK, MONTANA			
Reviewed	Recommended	Approved	
By	By	By	
Date	Date	Date	
100	100	100	
23-N-2			

WAR DEPARTMENT

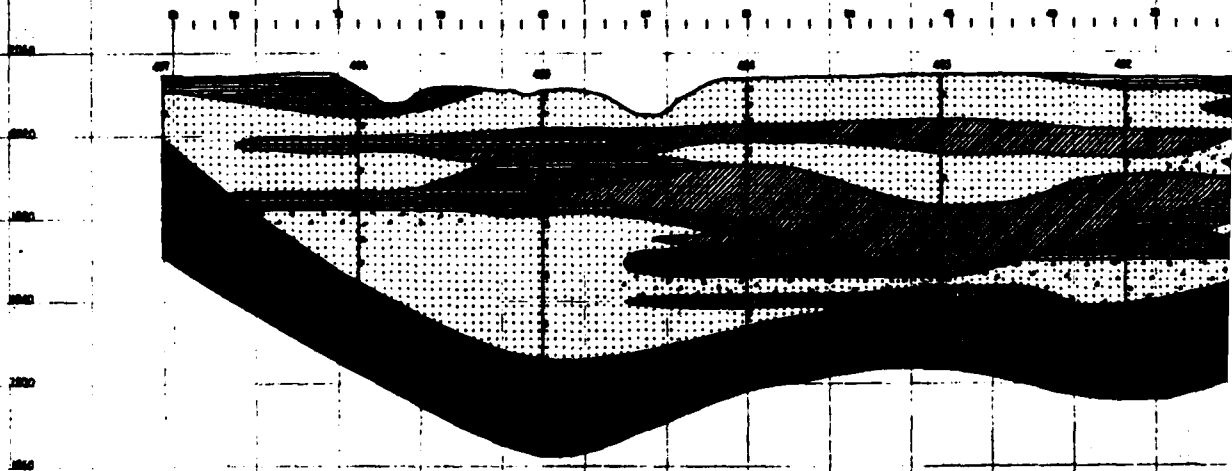




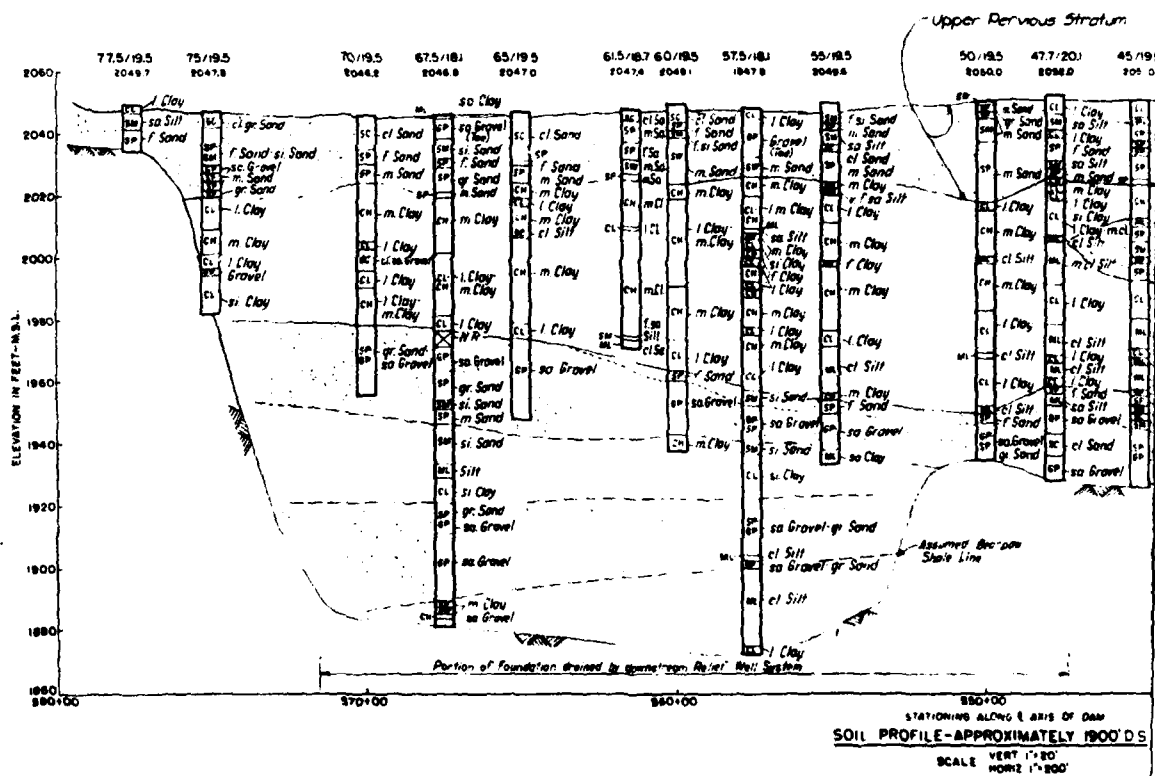
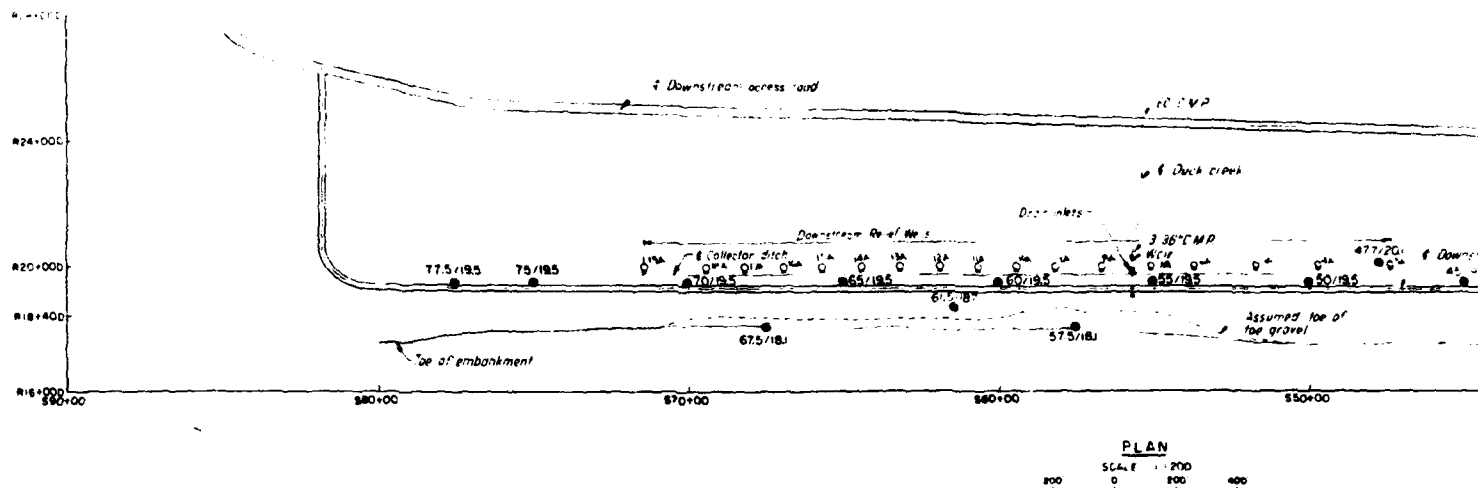
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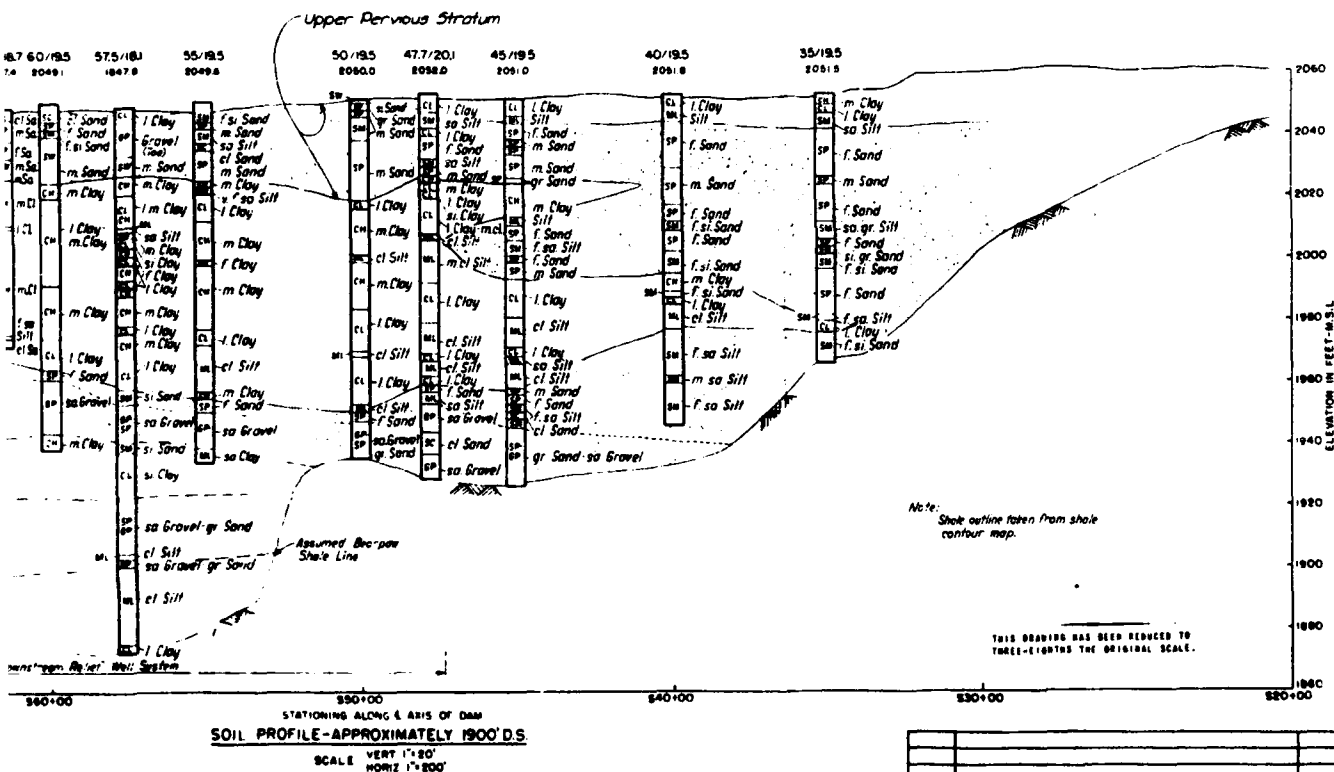
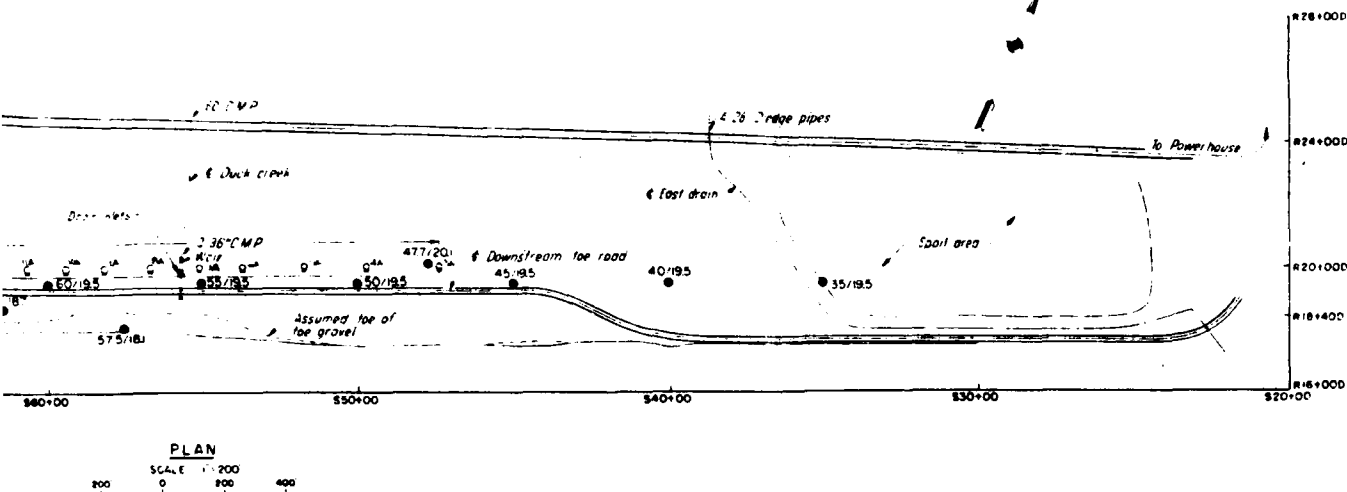


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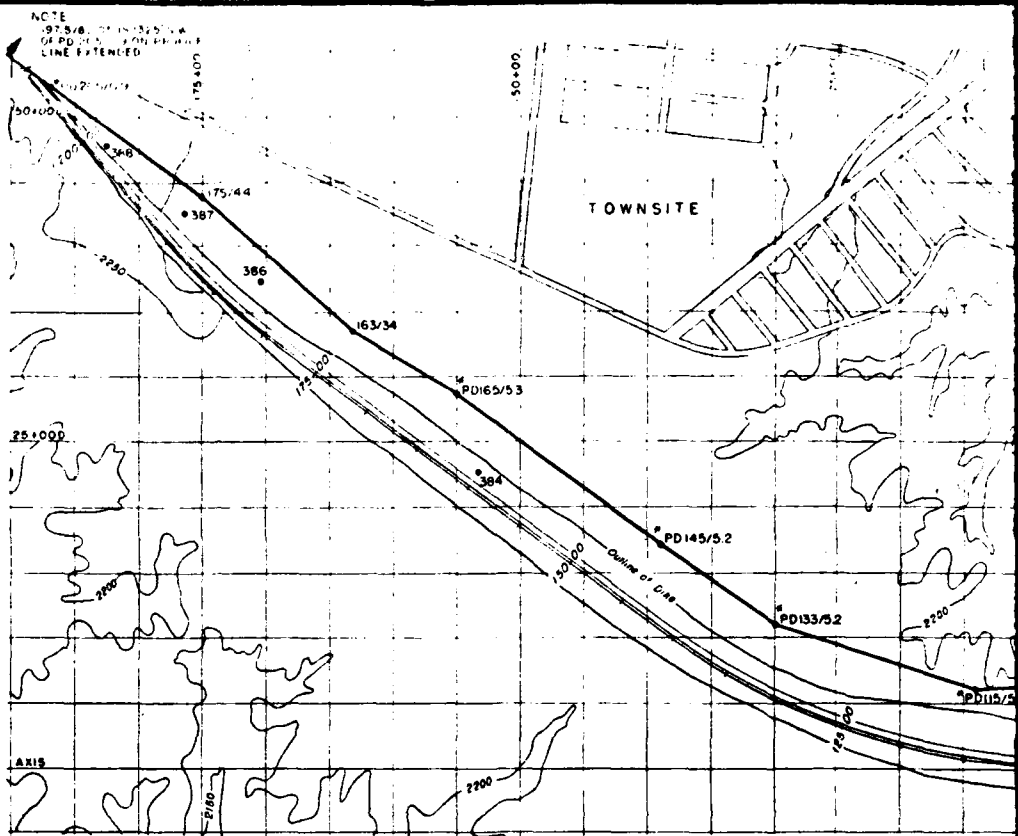


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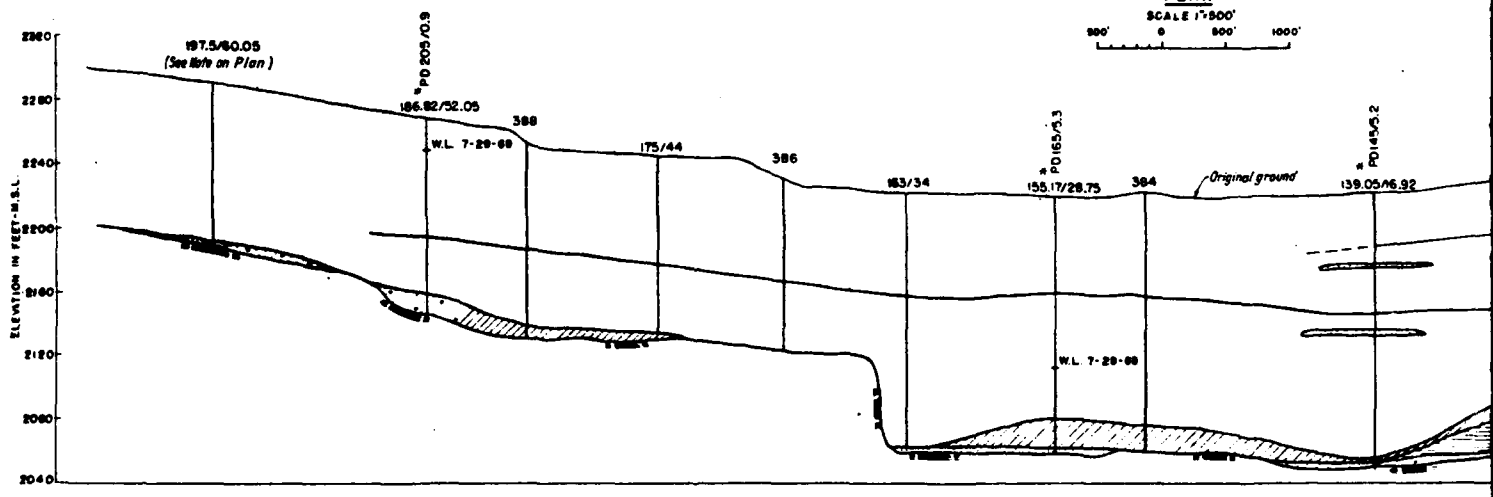




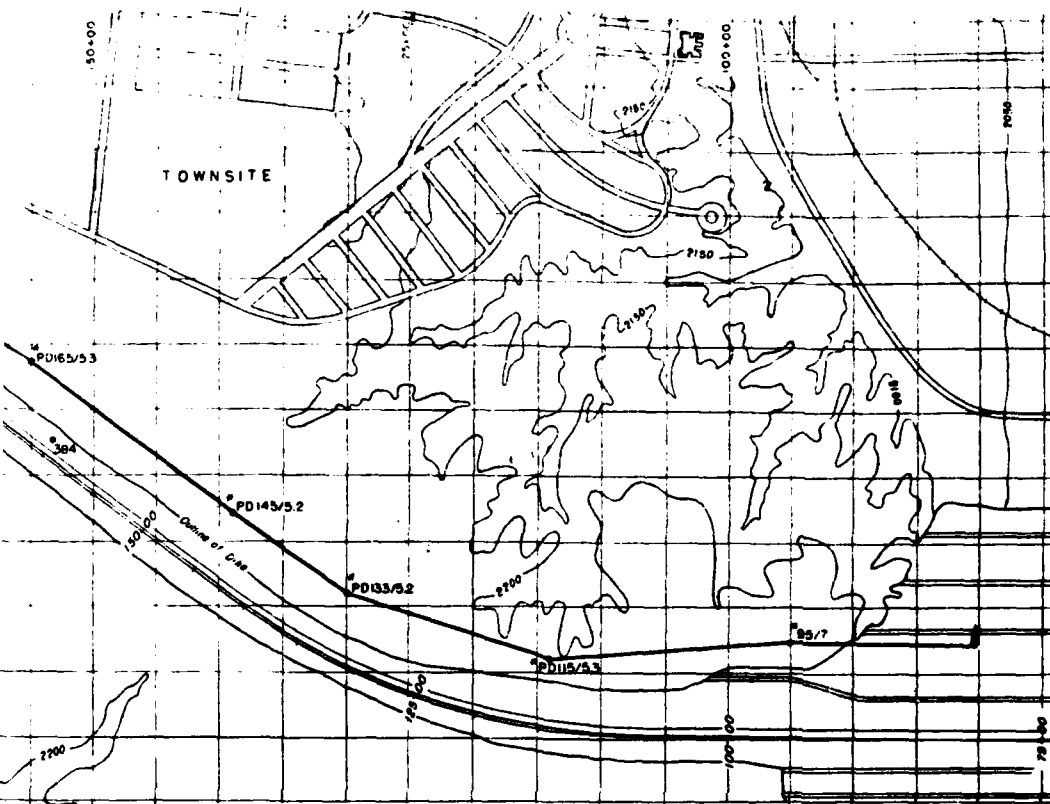
DATE		DESCRIPTION		DATE	APPROVED
SECTION					
U. S. ARMY ENGINEER DISTRICT, CHICAGO					
CORPS OF ENGINEERS					
CHICAGO, ILLINOIS					
MISSOURI RIVER					
FORT PECK DAM AND RESERVOIR					
TOE DRAIN REPORT					
SOIL PROFILE					
R 12+00 D					
DESIGNED BY	CHECKED BY	DATE	FOR	DATE	FOR
DRAWN BY	APPROVED BY	DATE	FOR	DATE	FOR
CHECKED BY	APPROVED BY	DATE	FOR	DATE	FOR
CHECKED BY	APPROVED BY	DATE	FOR	DATE	FOR



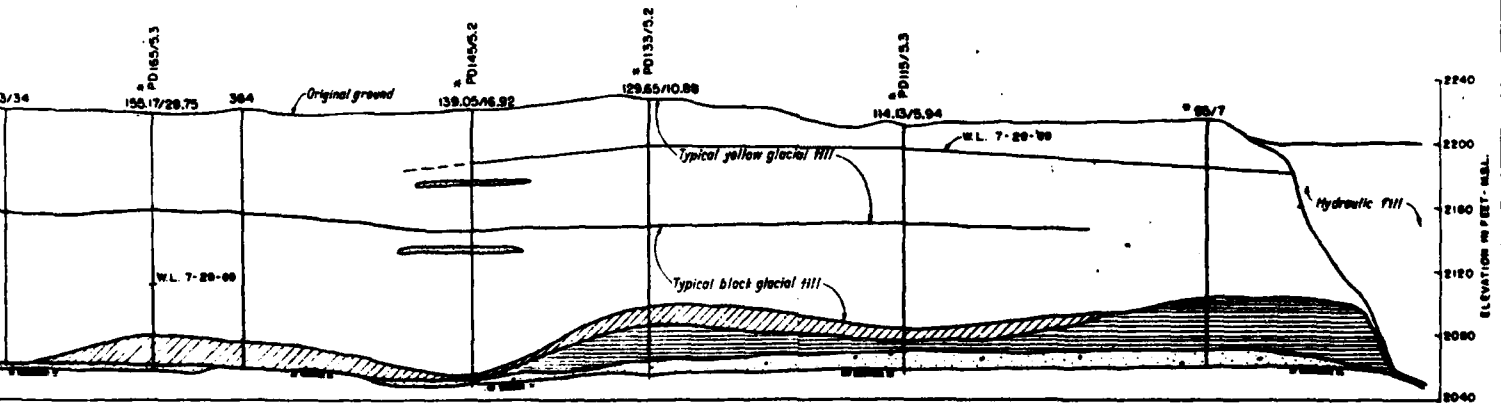
PLAN
SCALE 1"=500'
0 500' 1000'



PROFILE
HOR. 1"=400'
SCALE VERT. 1"=40'



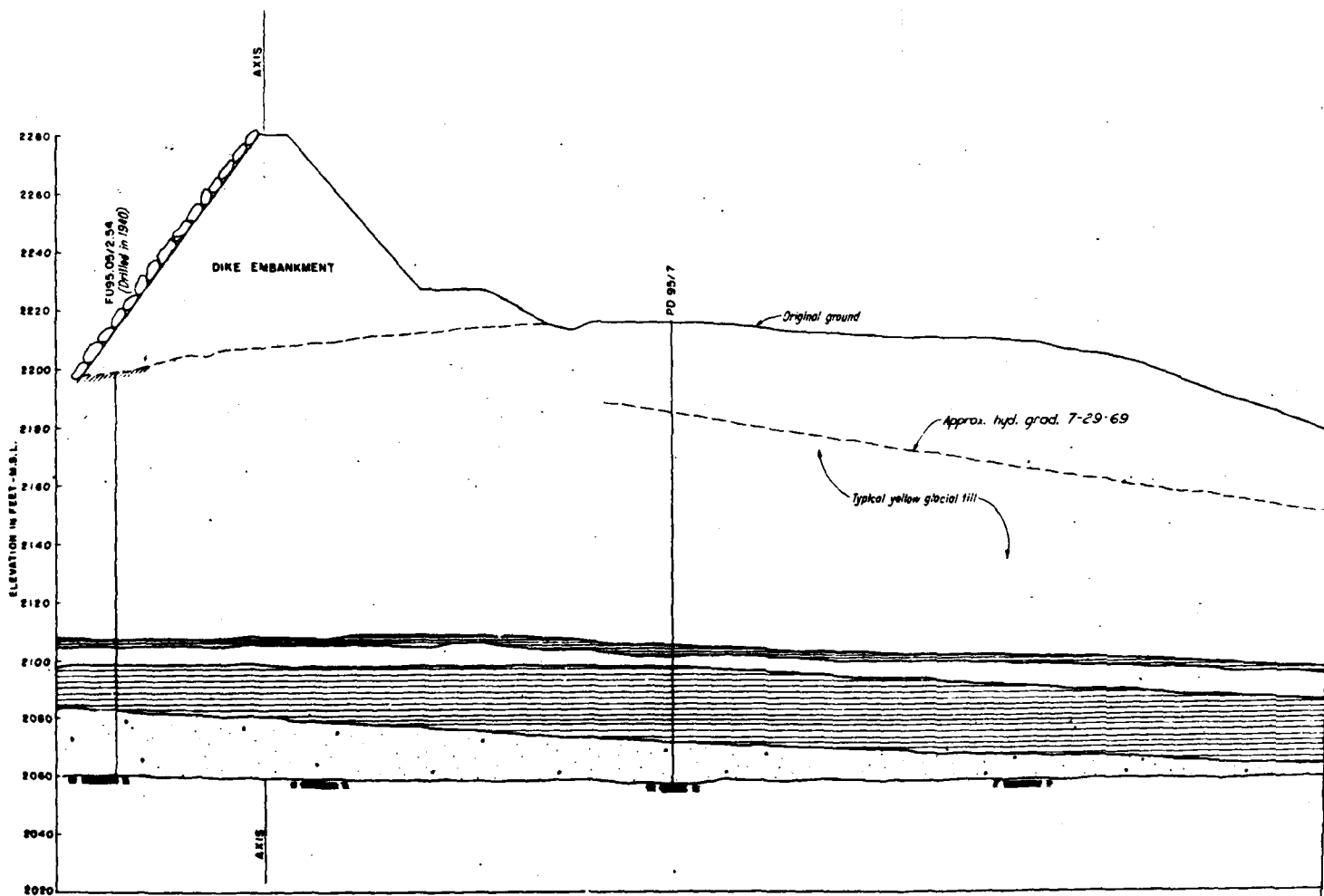
PLAN
SCALE 1"=500'
0 500 1000'



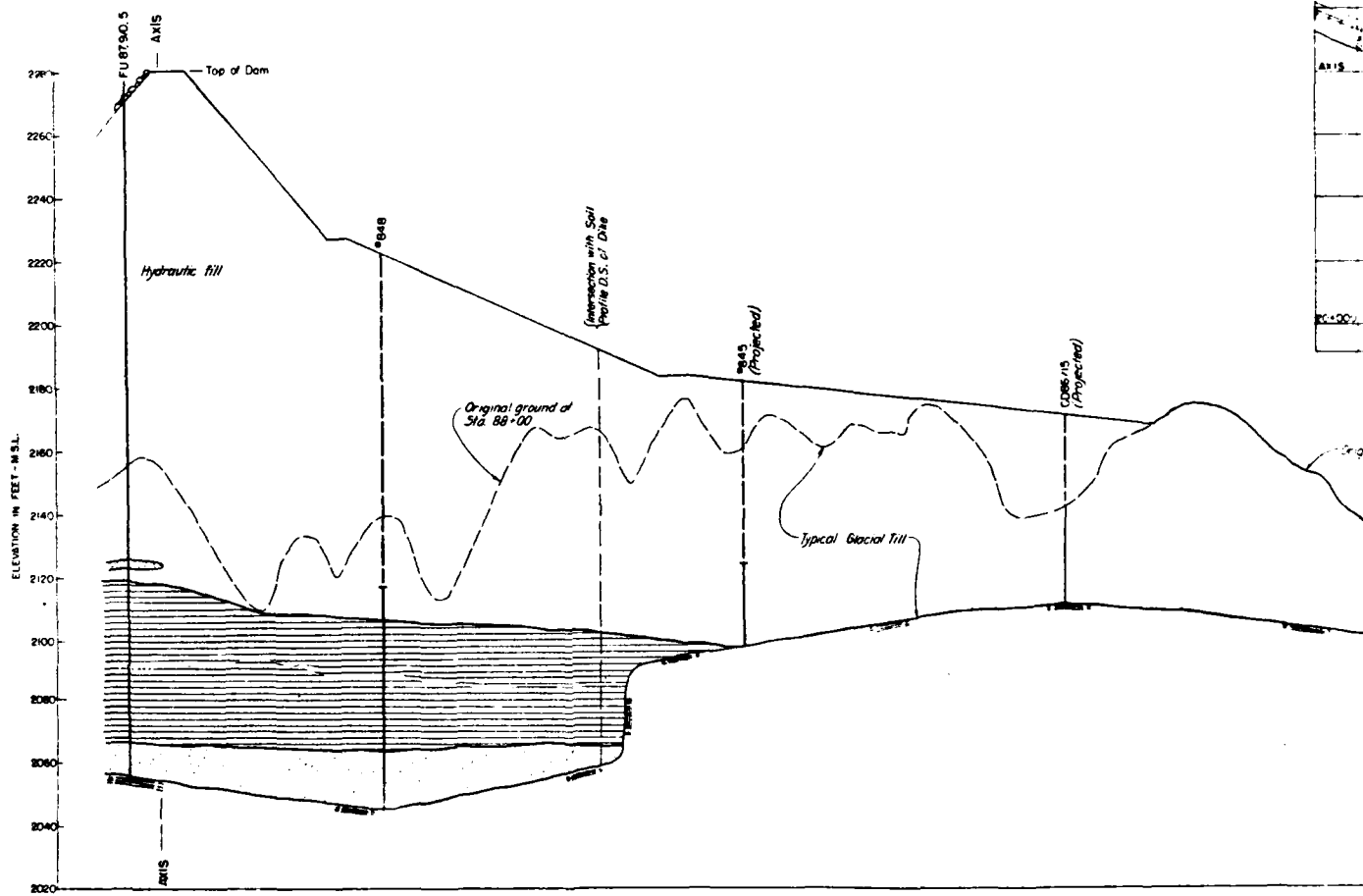
PROFILE
HOR. 1"=400'
SCALE VERT. 1"=40'

- LEGEND**
- Clay (Alluvial)
 - Loam
 - Permeable Sandy Material
 - Bearpaw Shale
 - Dike pipe locations refer to Dike Station and Range.

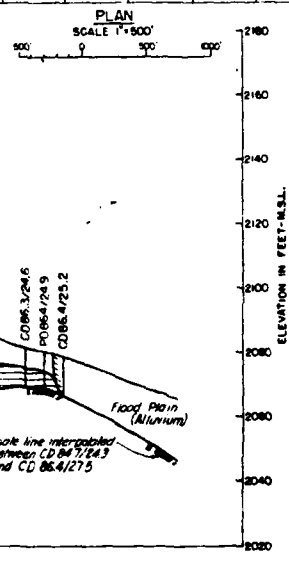
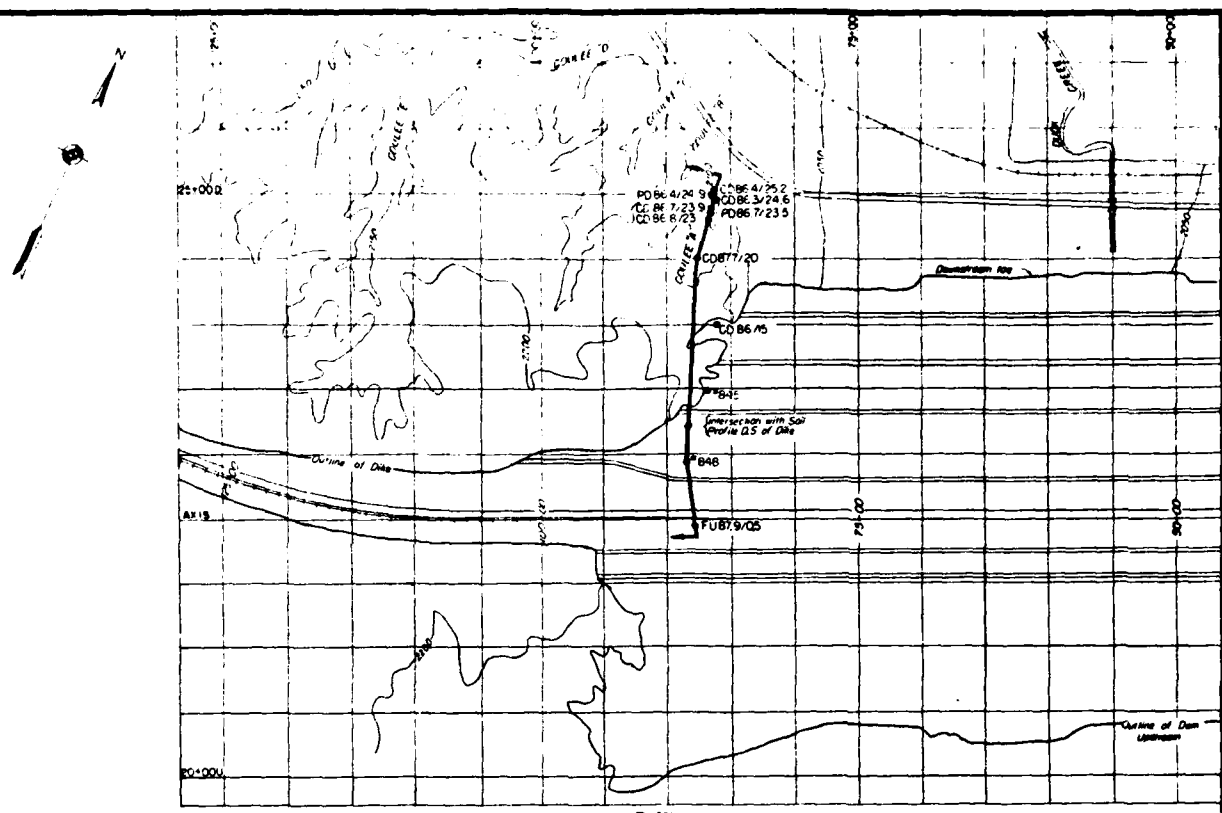
NO.		DATE		REVISION	
CORPS OF ENGINEERS, U. S. ARMY OFFICE OF THE DISTRICT ENGINEER ST. LOUIS, MO. MISSOURI RIVER FORT PECK DAM LEFT ABUTMENT SOIL PROFILE DOWNSTREAM OF DIKE					
DESIGNED BY CHECKED BY APPROVED BY DATE				JUNE 1957 6296.93C-26	



PROFILE
HOR. 1"=100'
SCALE VERT. 1"=20'



PROFILE
 SCALE VERT. 1"=20'

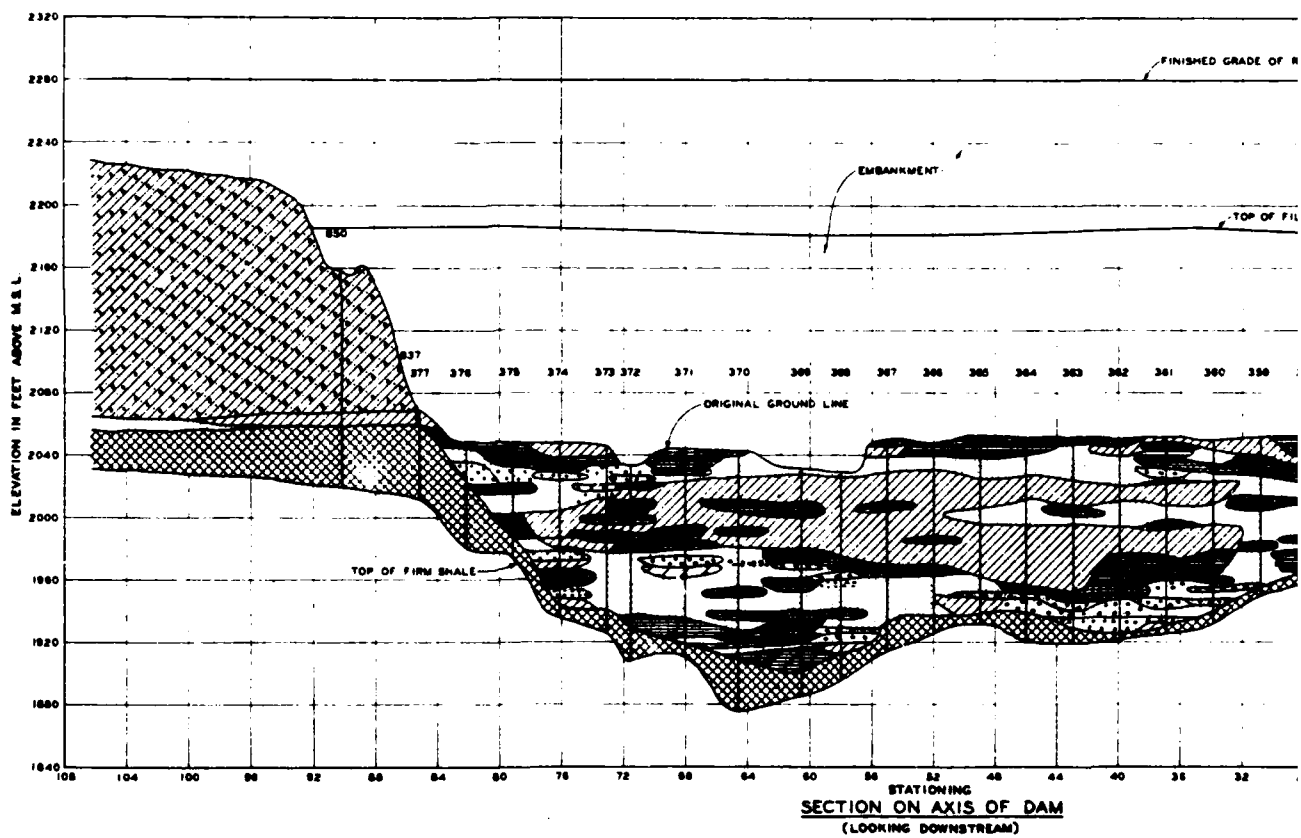
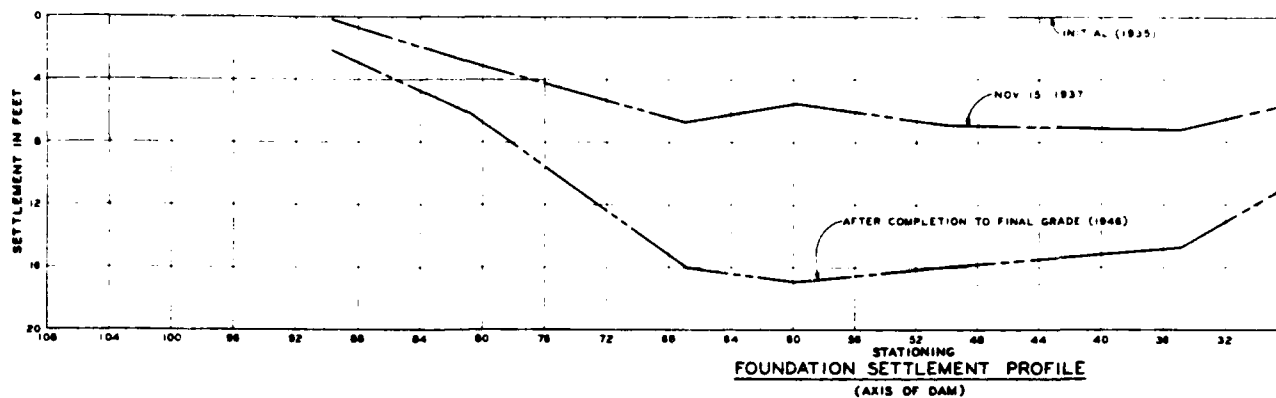


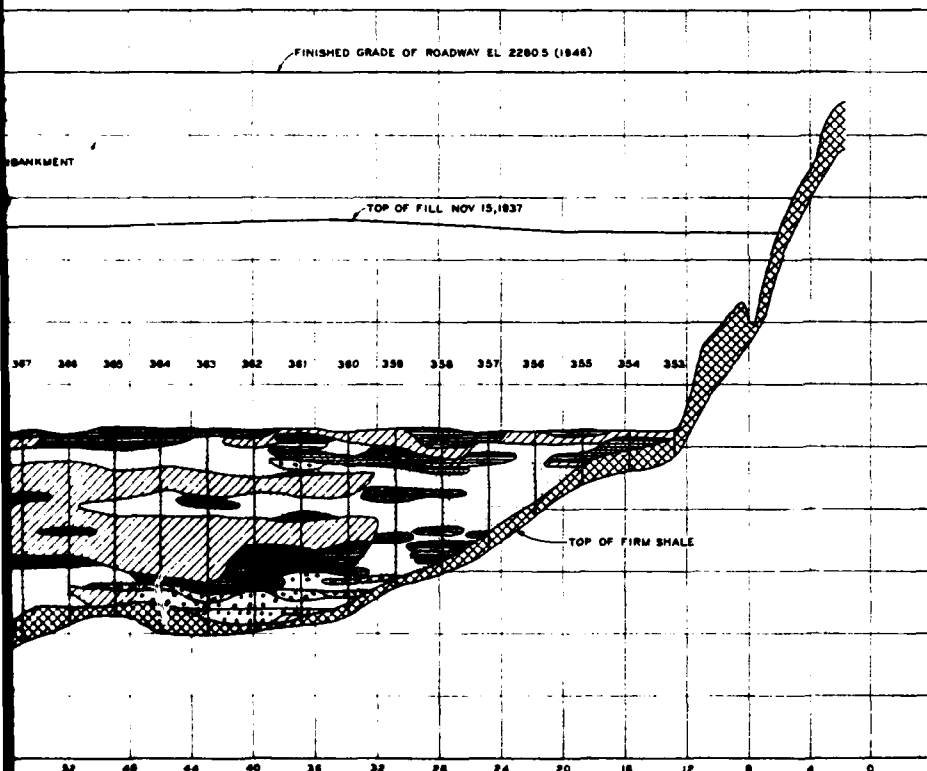
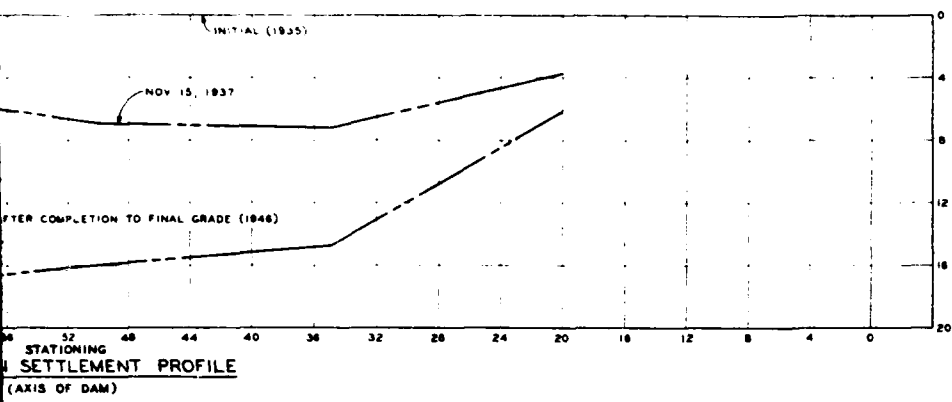
PROFILE
HORIZ. SCALE 1"=100
VERT. SCALE 1"=20

LEGEND

- Loam
- Perious Sandy Material
- Barren Sand

CORPS OF ENGINEERS, U. S. ARMY OFFICE OF THE CHIEF ENGINEER MISSOURI RIVER DISTRICT ST. LOUIS, MO.	
MISSOURI RIVER FORT PECK DAM	
LEFT ABUTMENT SOIL PROFILE COULEE "A"	
DATE: _____ DRAWN BY: _____ CHECKED BY: _____ APPROVED BY: _____	DATE: JUNE 1957 DRAWN BY: _____ CHECKED BY: _____ APPROVED BY: _____
6296.93C-29	





- LEGEND**
- SAND
 - GRAVELLY SAND
 - LOAM
 - SANDY LOAM
 - SANDY GRAVELLY LOAM
 - CLAY
 - SANDY CLAY
 - CLAY LOAM
 - SANDY CLAY LOAM
 - GRAVELLY CLAY LOAM
 - SANDY GRAVELLY CLAY LOAM
 - GRAVEL
 - SANDY GRAVEL
 - GLACIAL TILL
 - SHALE (EXCEPT FIRM)
- BUREAU OF SOILS CLASSIFICATION

NOTE:

1. PROFILE DATA TAKEN FROM DWG NO 6286 91-1-10 (FEB 1944)

2. EACH SUBSIDENCE PIPE IS AN EXTENSION OF A 3"Ø PIPE WELDED TO AN 18"Ø PLATE, IN TURN BOLTED TO A WOOD PLATFORM MEASURING 8' SQUARE. NO PROTECTIVE PIPE WAS PROVIDED; THEREFORE, STRAIN DUE TO SKIN FRICTION IS REALIZED.

THIS DESIGN HAS BEEN REDUCED TO THREE-FIFTHS THE ORIGINAL SCALE.

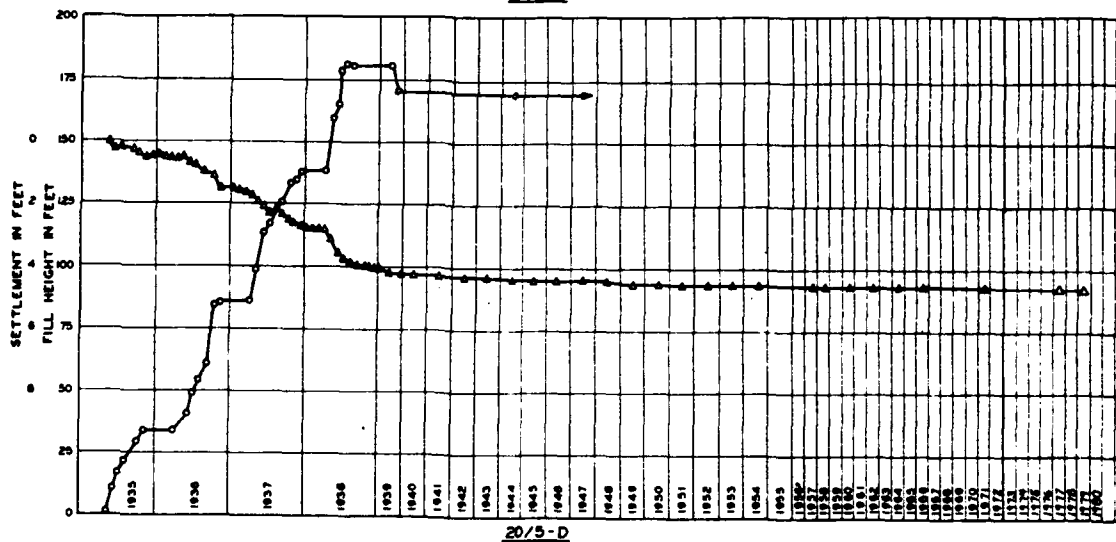
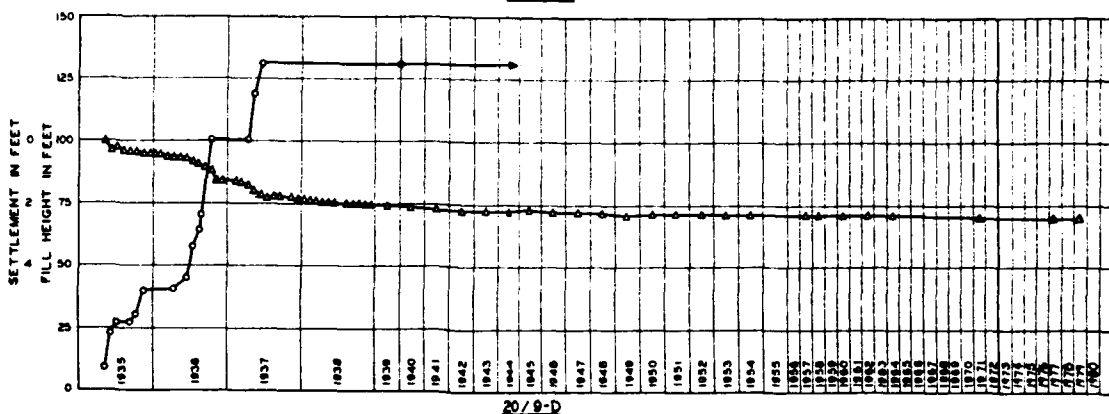
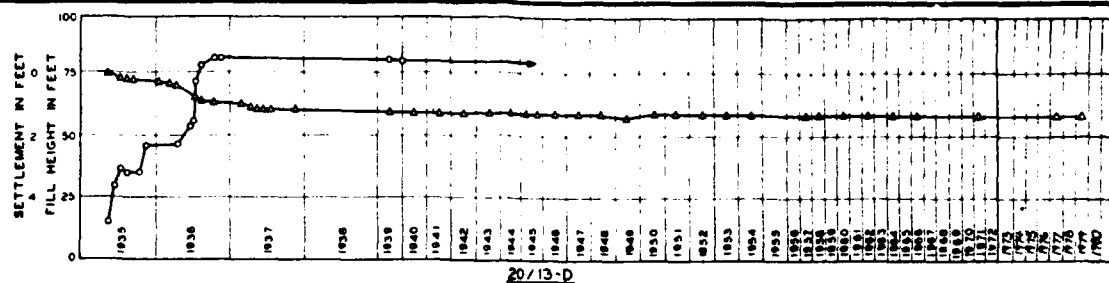
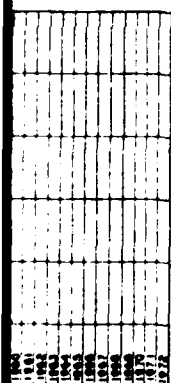


SCALE VERT 1 INCH = 40 FEET
HORIZ 1 INCH = 400 FEET

THIS PLAN ACCOMPANIES CONTRACT NO. 100-100-100-100

DATE		REVISIONS		CHECKED		APPROVED	
U. S. ARMY ENGINEER DISTRICT, OMAHA GROUP OF ENGINEERS OMAHA, NEBRASKA							
DESIGNED BY: O. W. A.				MISSOURI RIVER FORT PECK LAKE, MONTANA			
CHECKED BY: L. W. A.				SUMMARY OF FOUNDATION SETTLEMENT AND FOUNDATION PROFILE (SUBSIDENCE PIPES)			
DRAWN BY: O. W. A.				DATE: 1944			
CHECKED BY: O. W. A.				DATE: 1944			
APPROVED BY: O. W. A.				DATE: 1944			
APPROVED BY: O. W. A.				DATE: 1944			

2



THIS DRAWING HAS BEEN REDUCED TO
THREE-EIGHTHS THE ORIGINAL SCALE.

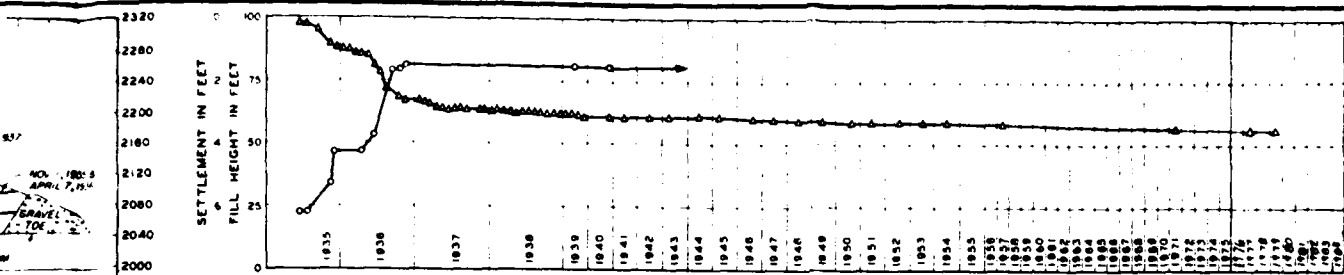
LEGEND

 FILL HEIGHT IN FEET
 SETTLEMENT IN FEET

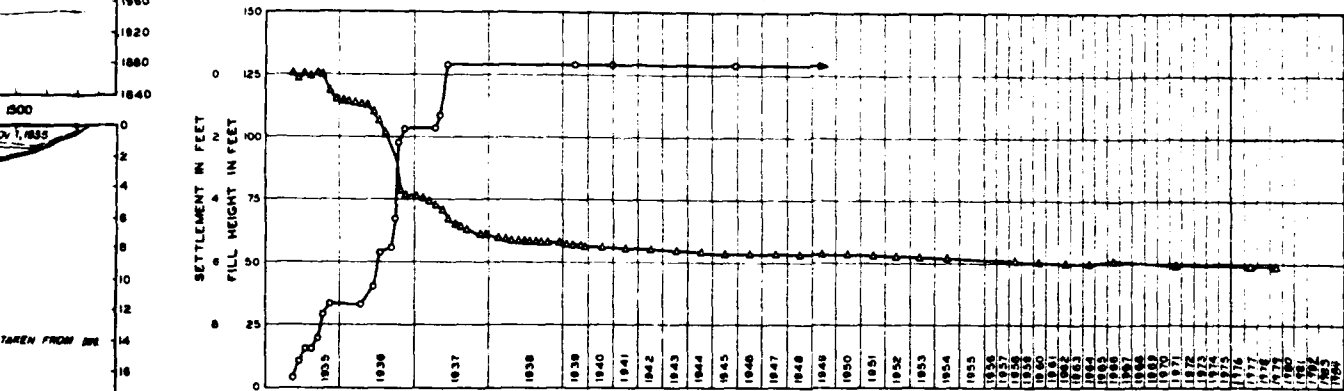


THIS PLAN ACCOMPANIES CONTRACT NO. _____
MODIFICATION NO. _____

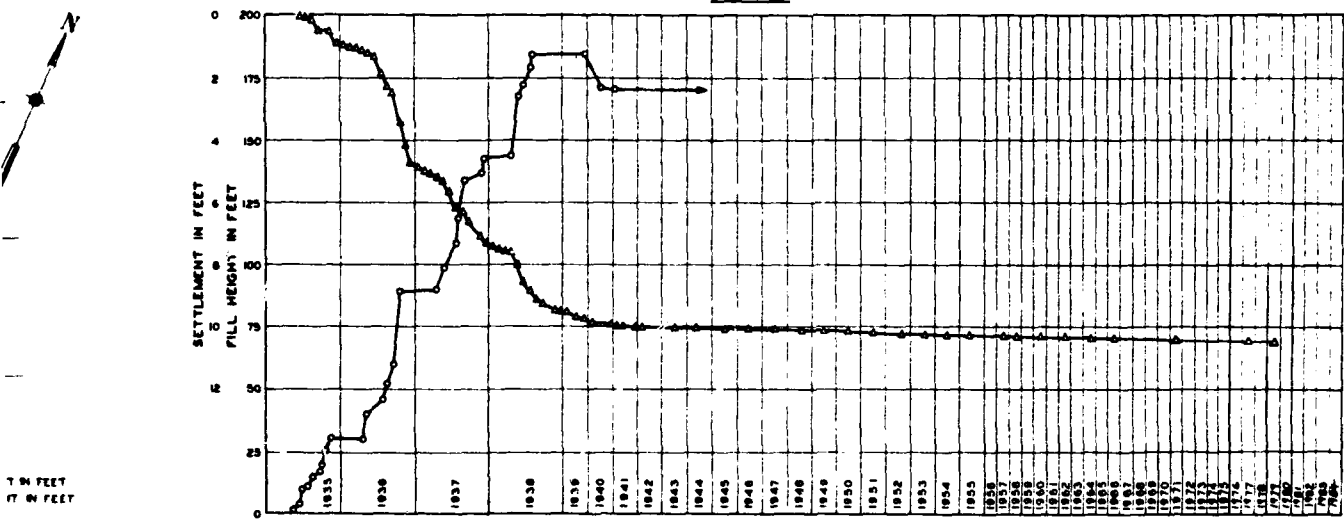
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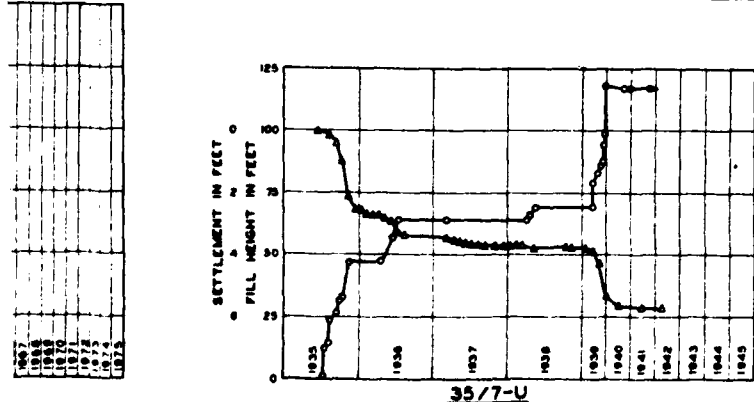
35/13-D



35/9-D



35/5-D



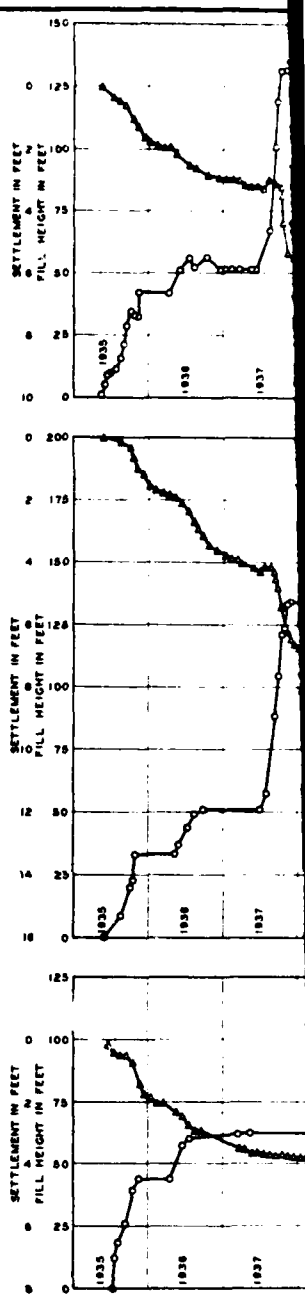
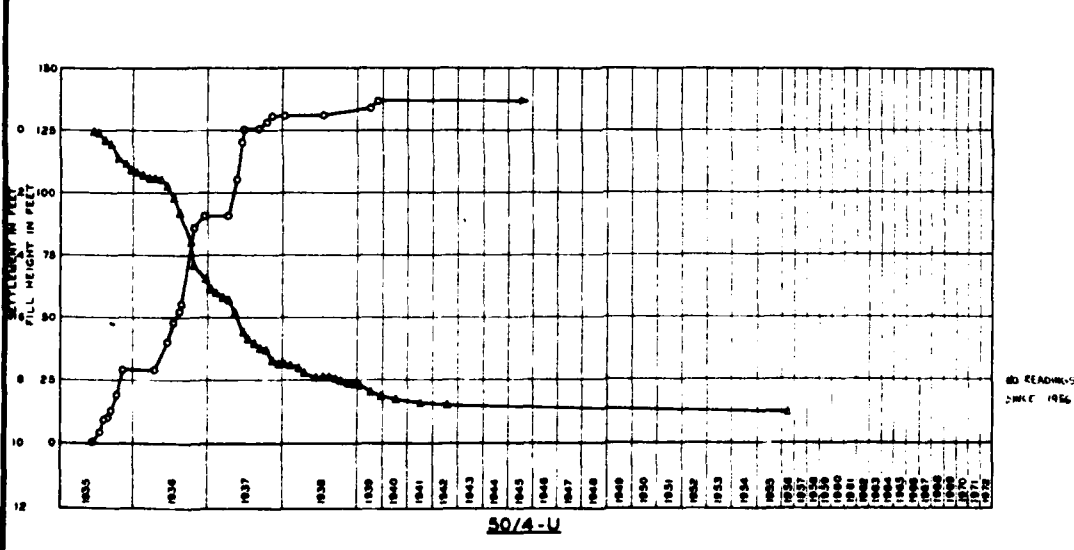
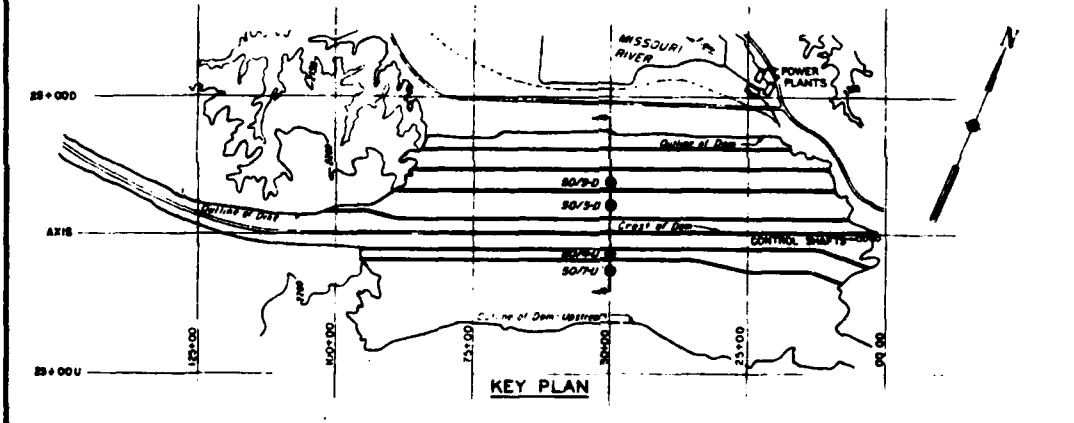
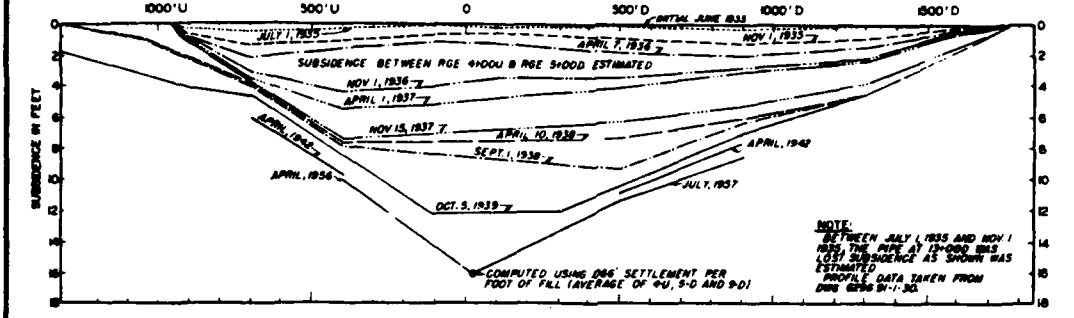
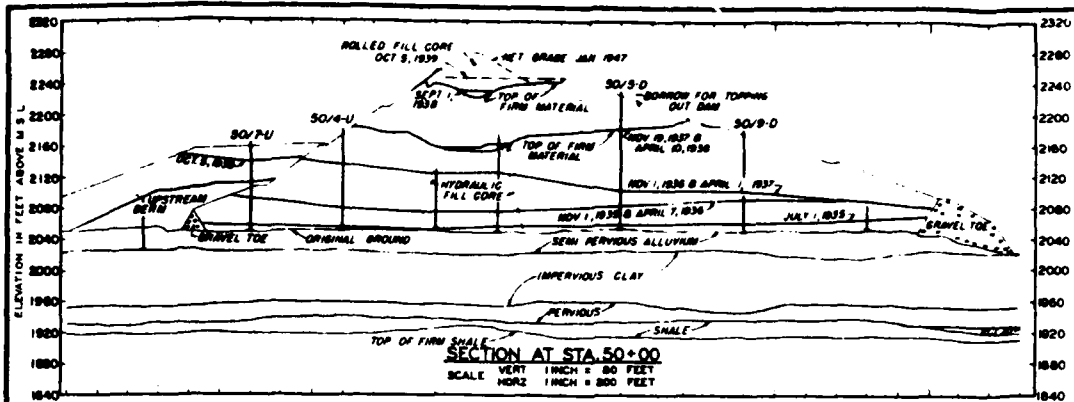
35/7-U

THIS DRAWING HAS BEEN REDUCED TO
THREE-FIFTHS THE ORIGINAL SCALE.



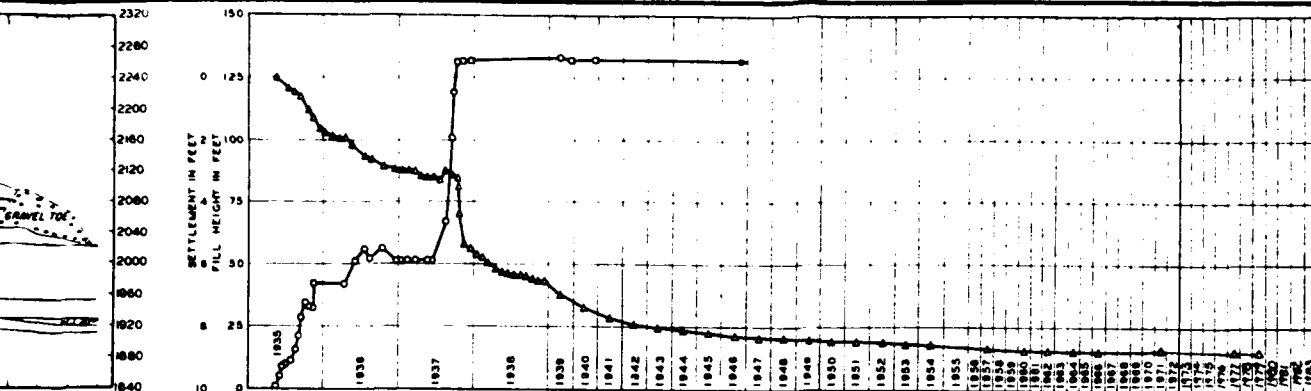
TWO PLAN APPROVED CONTRACT NO.
MODIFICATION NO.

DATE		DESCRIPTION		REVIS	APPROV
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U. S. ARMY ENGINEER DISTRICT, OHAMA					
CORPS OF ENGINEERS					
OHAMA, NEBRASKA					
MISSOURI RIVER					
FORT PECK LAKE, MONTANA					
SUMMARY OF FOUNDATION SETTLEMENT					
STATION 35+00					
DESIGNED BY: A. J. W.	CHECKED BY: H. A.	DESIGNED BY: G. H.	CHECKED BY: G. H.		
DRAWN BY: J. L. W.		CHECKED BY: J. L. W.			
DATE: 10/1/52		DATE: 10/1/52			
BY: J. L. W.		BY: J. L. W.			
DATE: 10/1/52		DATE: 10/1/52			
BY: J. L. W.		BY: J. L. W.			
DATE: 10/1/52		DATE: 10/1/52			

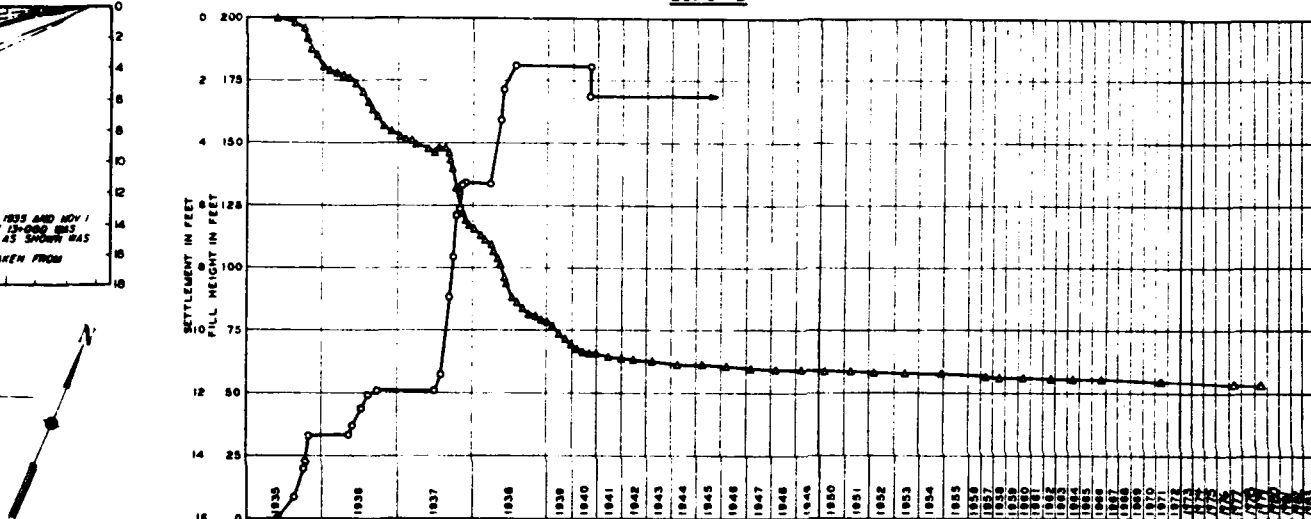


LEGEND:
 ○ FILL HEIGHT IN FEET
 ● SETTLEMENT IN FEET

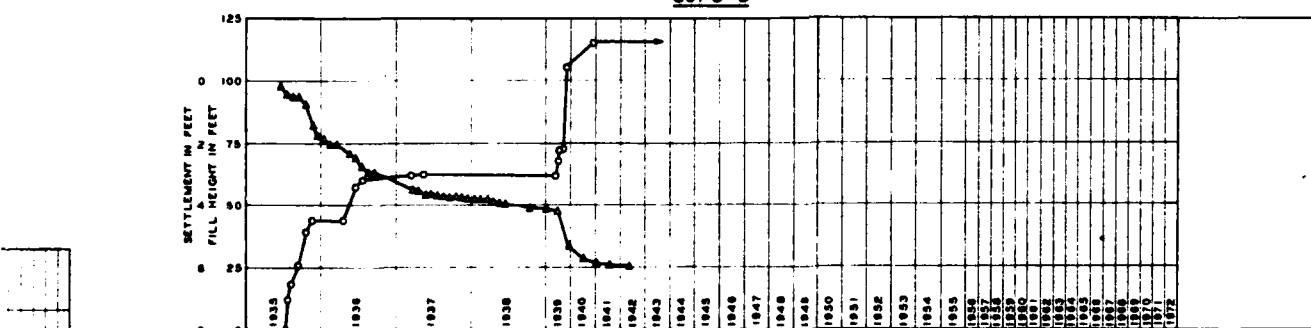
RD READING
 2 INCH 1956



50/9-D



50/5-D



50/7-U

LEGEND

- FILL HEIGHT IN FEET
- SETTLEMENT IN FEET

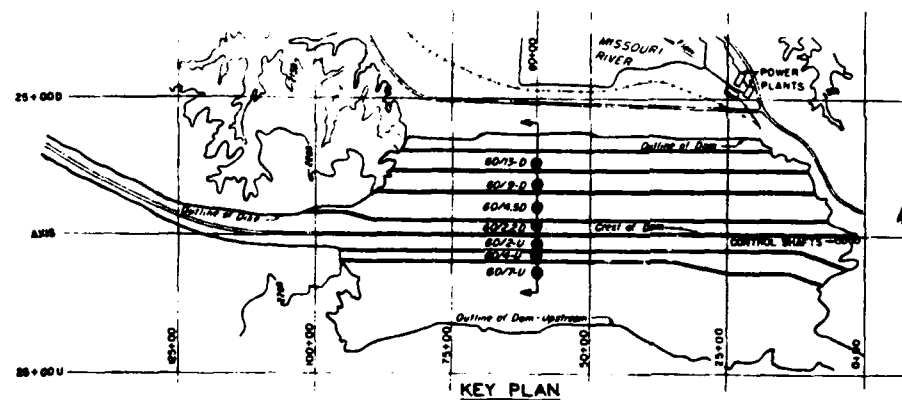
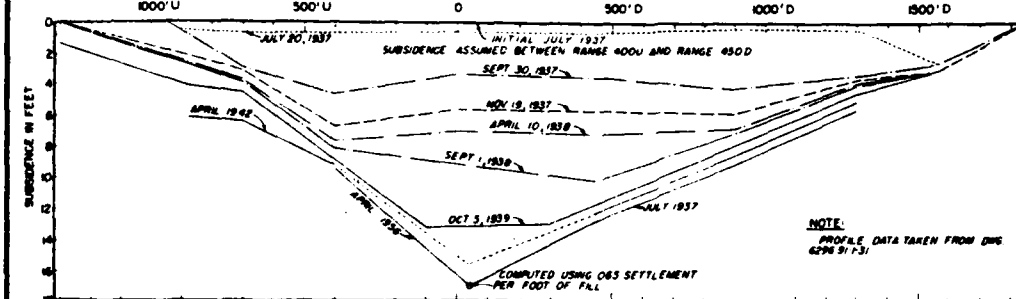
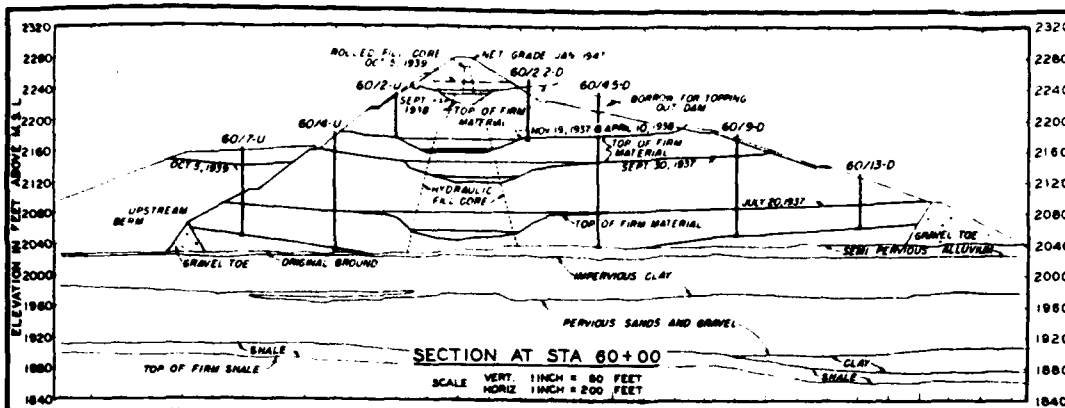


THIS PLAN ACCOMPANIES CERTIFICATE NO. _____
REGISTRATION NO. _____

THIS DRAWING HAS BEEN REDUCED TO
THREE-EIGHTHS THE ORIGINAL SCALE.

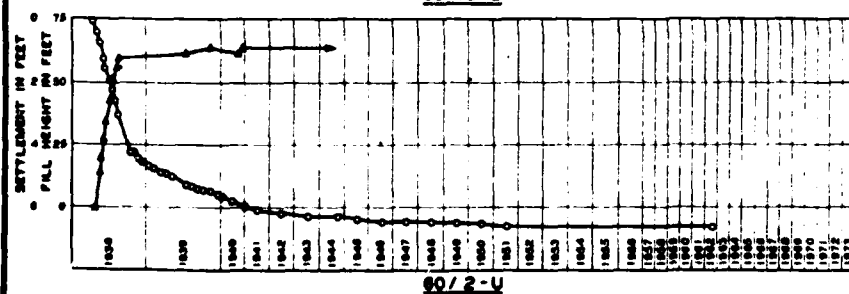
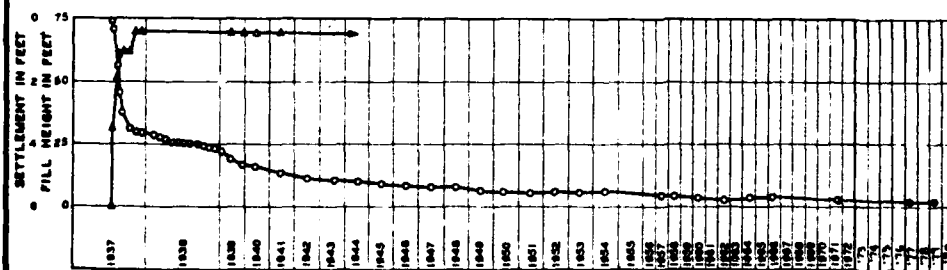
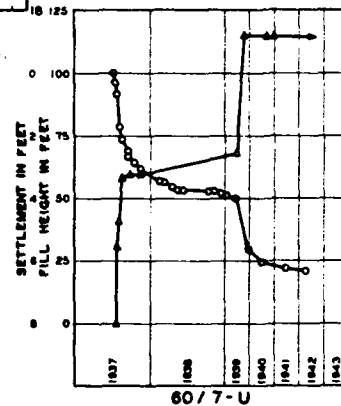
DATE _____		DESIGNER _____		CHECKED _____	
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA					
PROJECT NO. _____		STATION 50+00			
DRAWN BY _____		FORT PECK LAKE, MONTANA			
CHECKED BY _____		SUMMARY OF FOUNDATION SETTLEMENT			
APPROVED BY _____		STATION 50+00			
DATE _____		DATE _____		DATE _____	
BY _____		BY _____		BY _____	

CONSTRUCTION FOUNDATION REPORT



LEGEND:

- — FILL HEIGHT IN FEET
- — SETTLEMENT IN FEET



SETTLEMENT IN FEET
FILL HEIGHT IN FEET

225
200
175
150
125
100
75
50
25
0

12
10
8
6
4
2
0

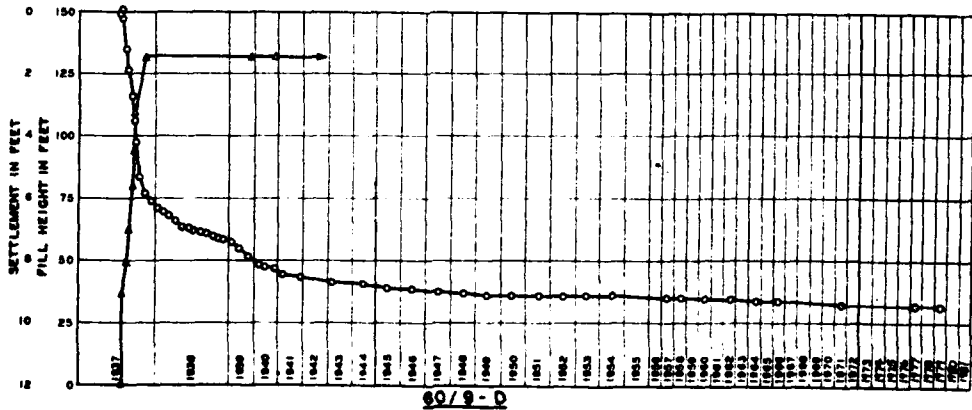
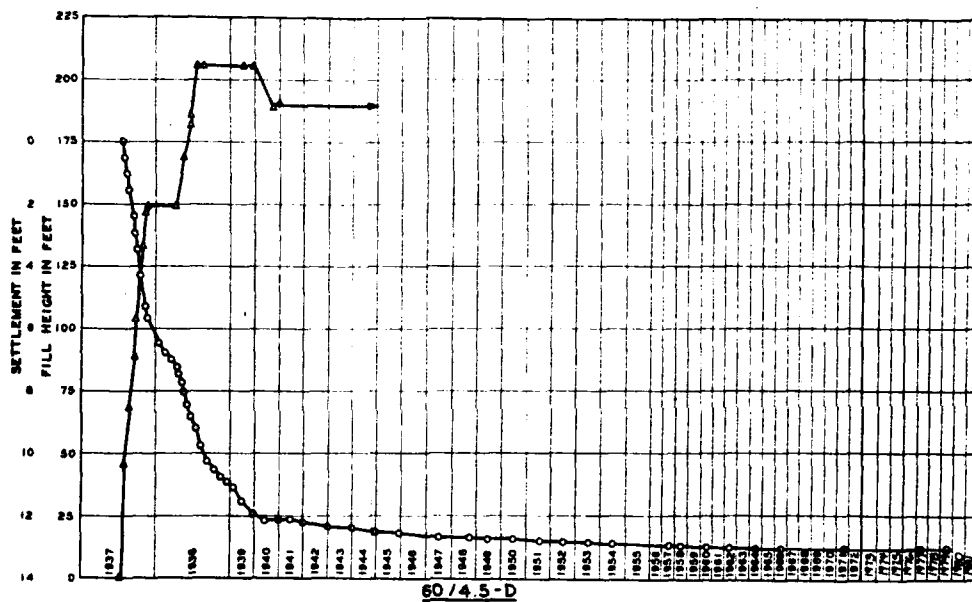
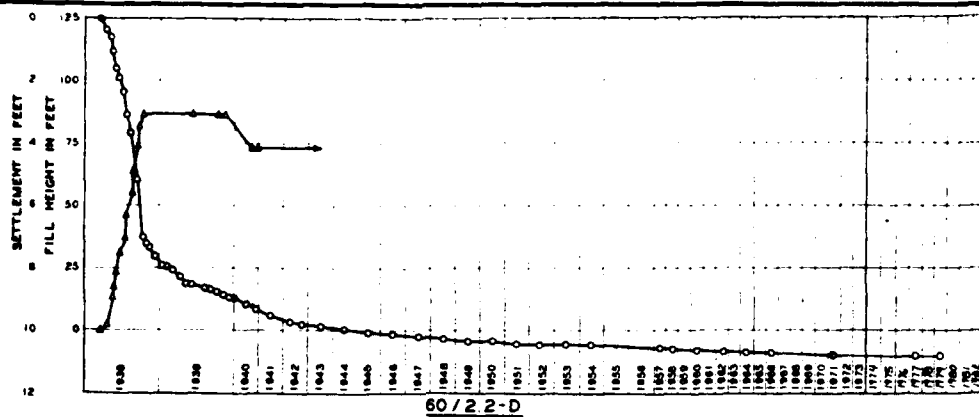
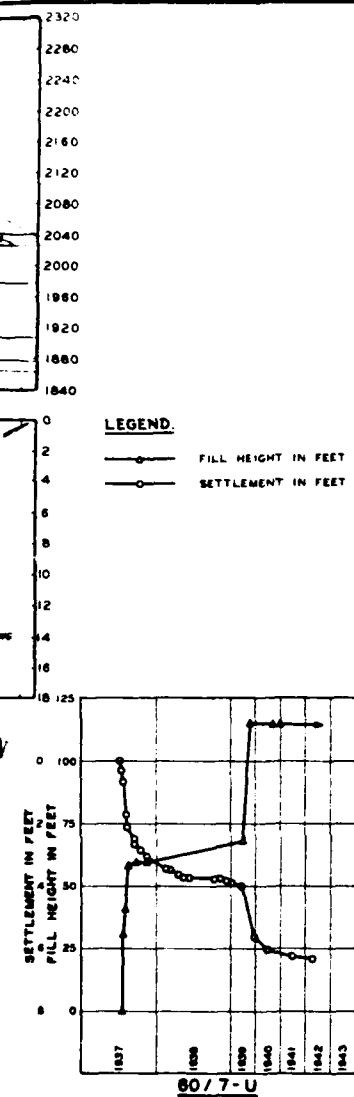
125
100
75
50
25
0

12
10
8
6
4
2
0

125
100
75
50
25
0

12
10
8
6
4
2
0

12
10
8
6
4
2
0

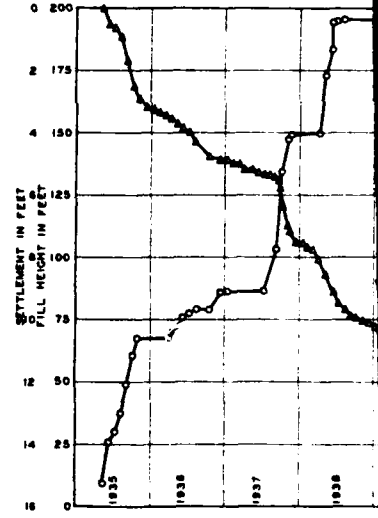
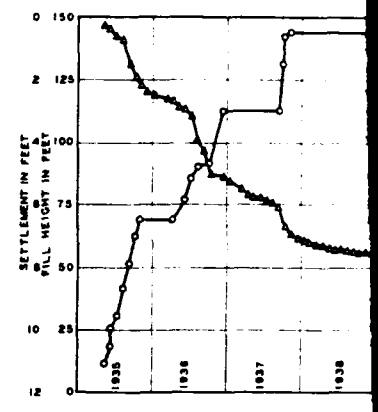
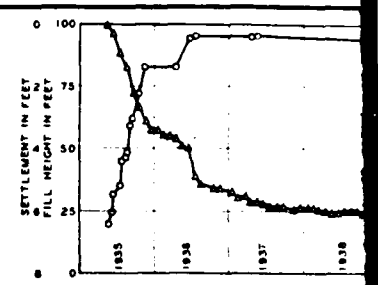
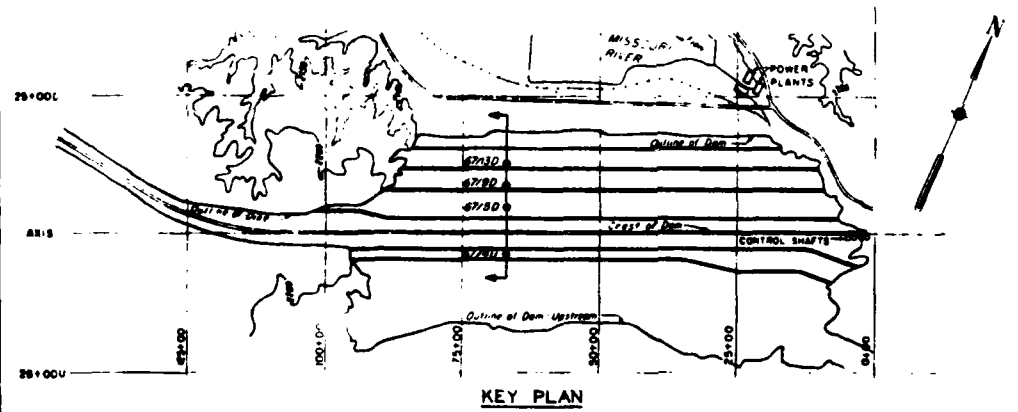
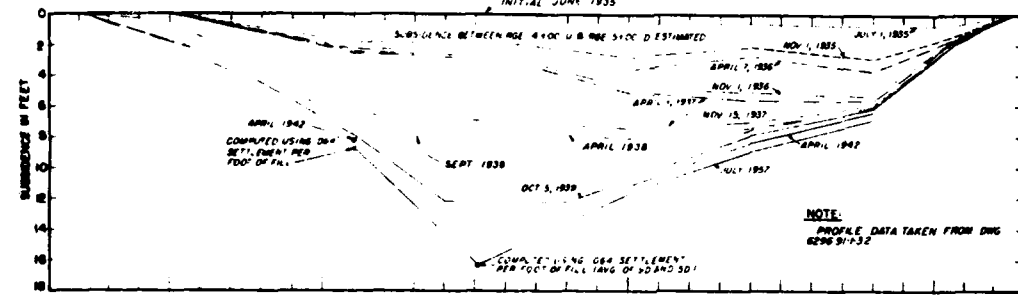
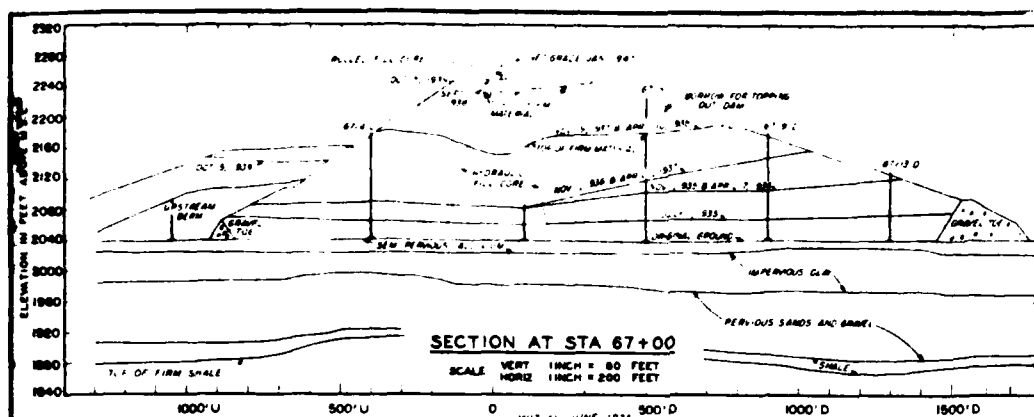


THIS DRAWING HAS BEEN REDUCED TO
THREE-EIGHTH THE ORIGINAL SCALE

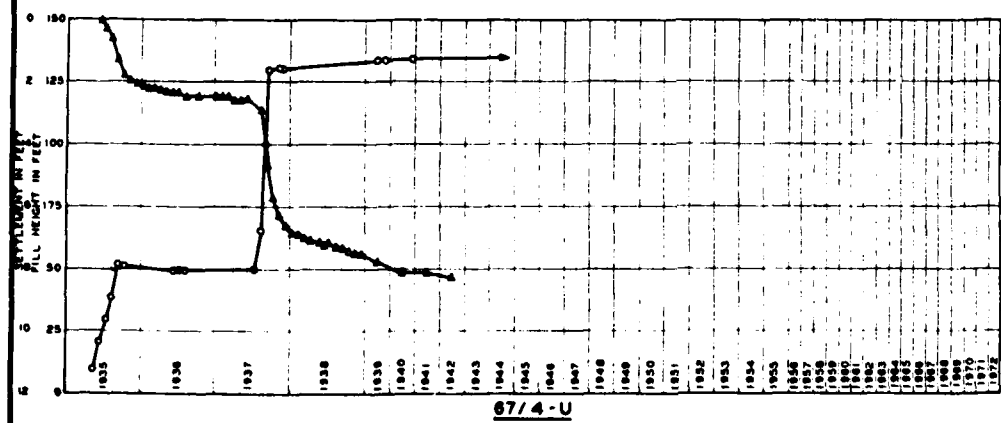


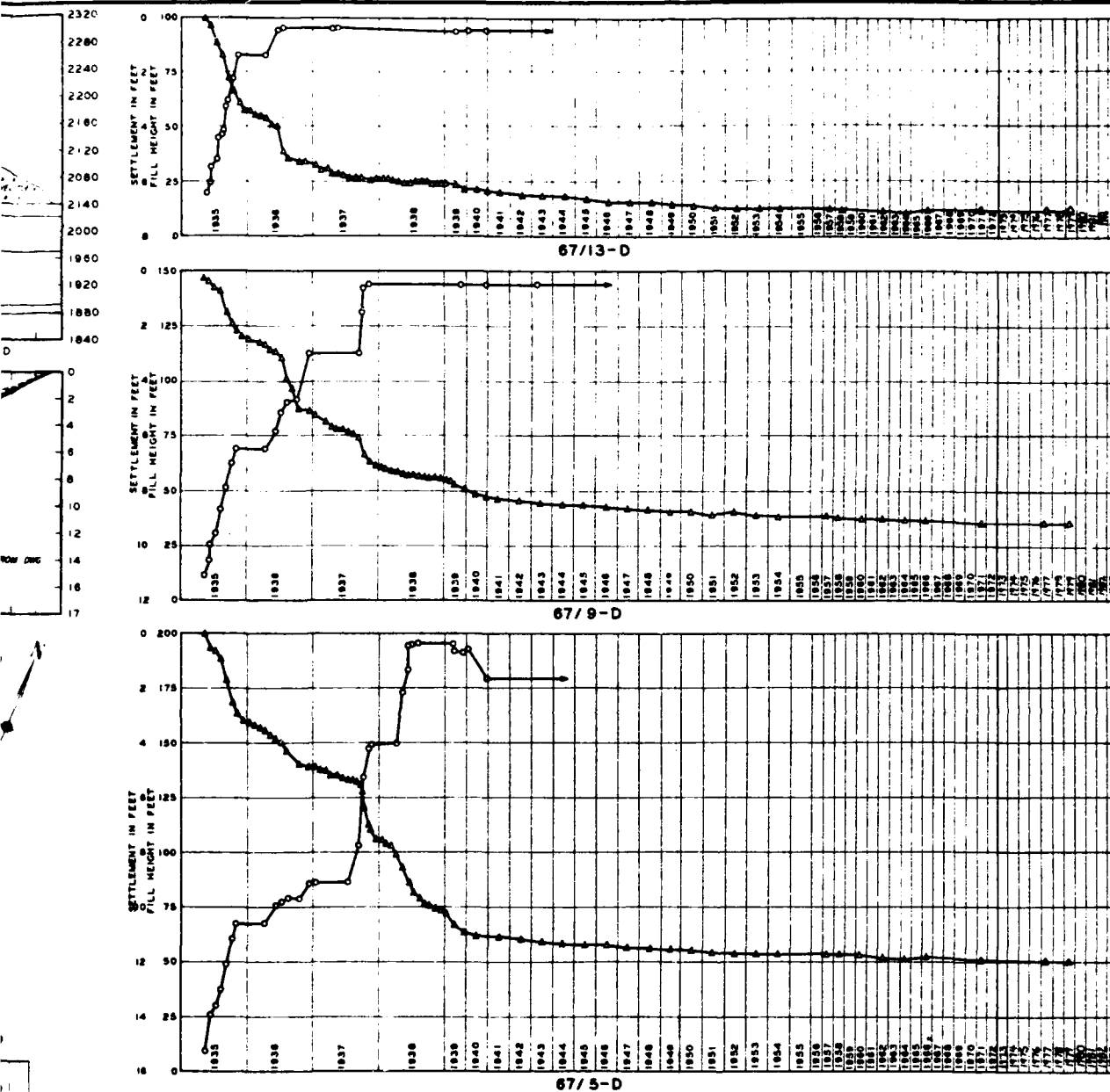
THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.

U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA	
MISSOURI RIVER FORT PECK LAKE, MONTANA	
SUMMARY OF FOUNDATION SETTLEMENT STATION 60+00	
DESIGNED BY: P. J. ST.	DATE: 1954
DRAWN BY: L. M. S.	DATE: 1954
CHECKED BY: C. W. A.	DATE: 1954
APPROVED BY: C. W. A.	DATE: 1954
CONSTRUCTION NO.	DATE
CONSTRUCTION NO.	DATE
CONSTRUCTION NO.	DATE



LEGEND:
 ○ FILL HEIGHT IN FEET
 ● SETTLEMENT IN FEET





LEGEND:

○ FILL HEIGHT IN FEET
● SETTLEMENT IN FEET

THIS DRAWING HAS BEEN REDUCED TO
THREE-FOURTHS THE ORIGINAL SCALE.



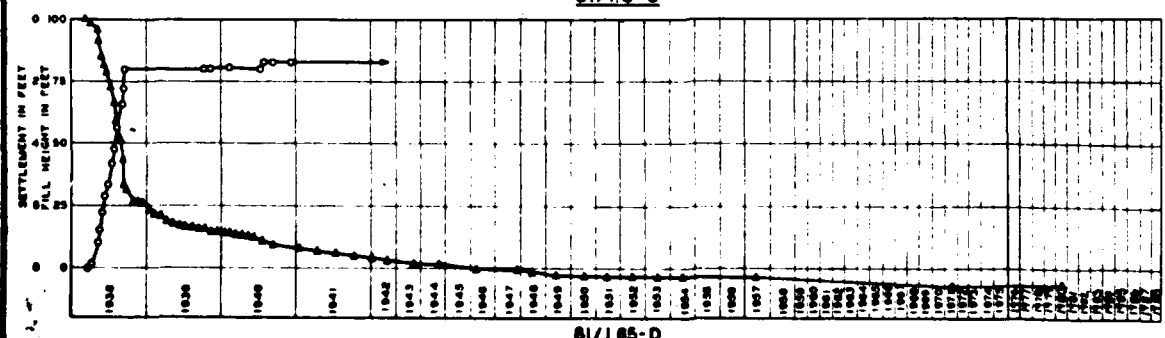
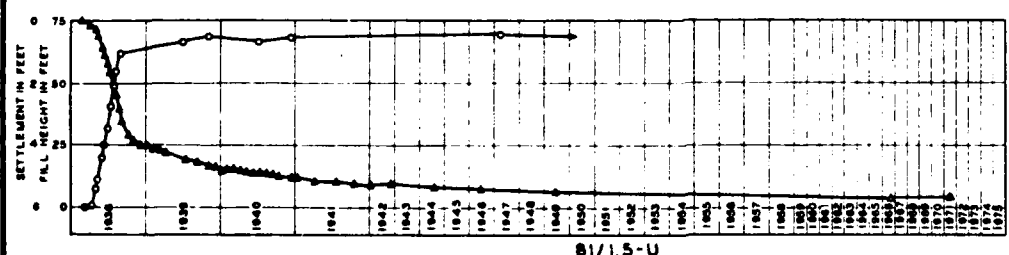
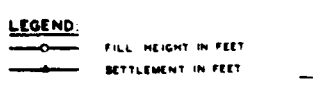
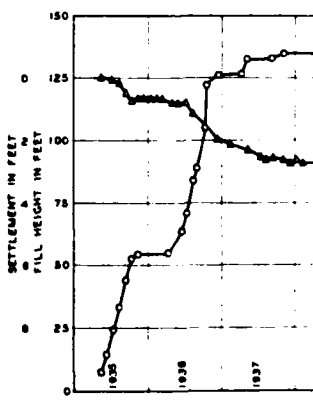
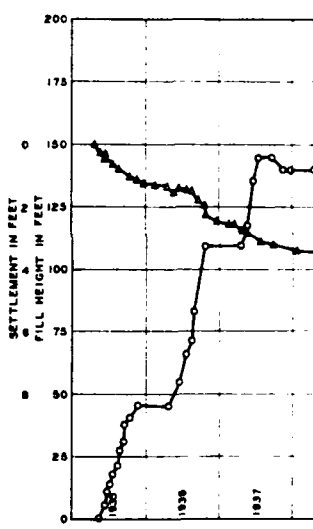
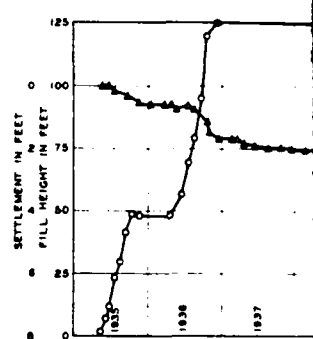
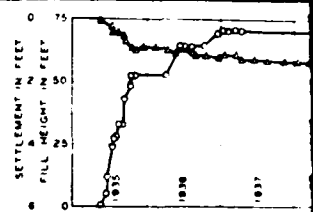
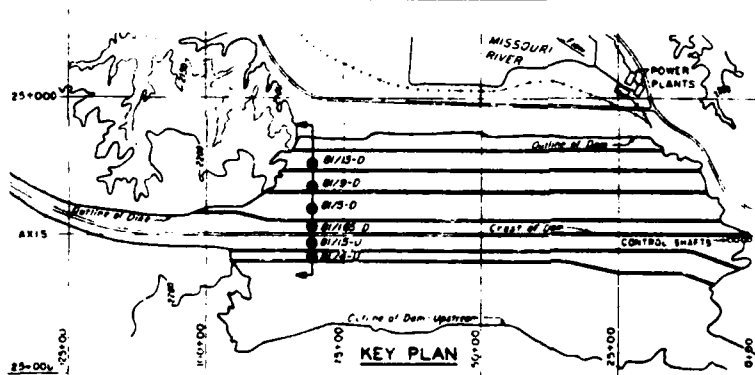
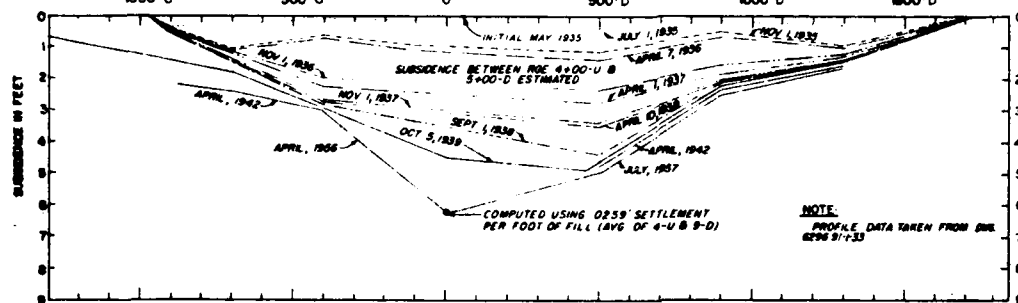
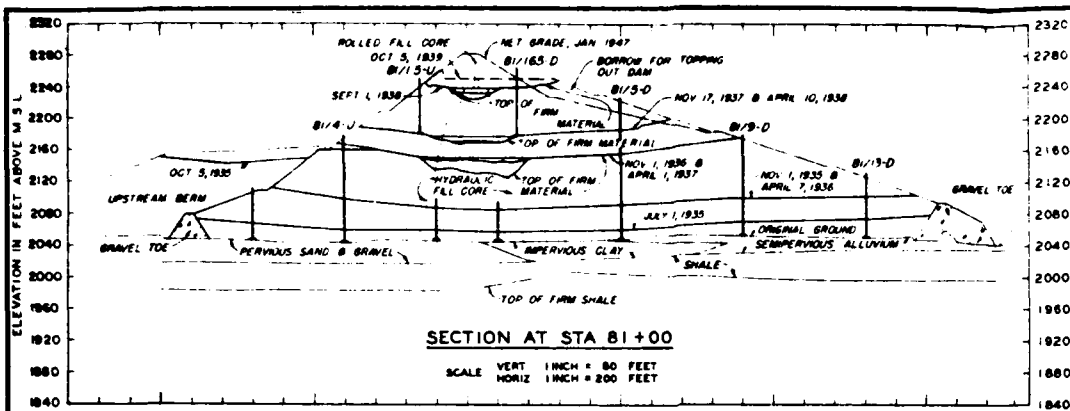
THIS PLAN ASSUMES CONTRACT NO.
MODIFICATION NO.

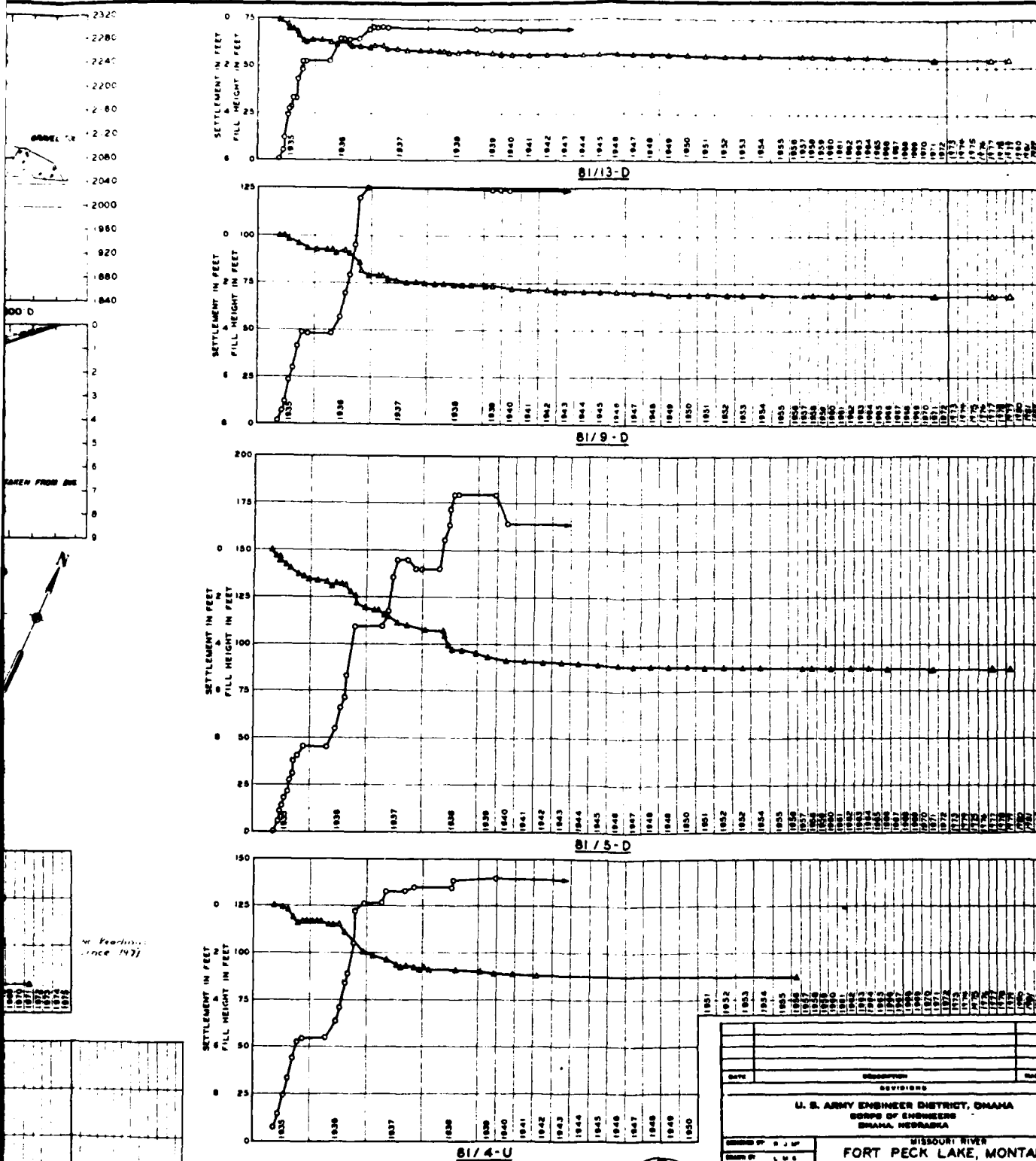
DATE	DESCRIPTION	SCALE	APPROVED
DIVISION			
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA			
DESIGNED BY: D. J. M. CHECKED BY: L. M. C. APPROVED BY: O. W. A.		MISSOURI RIVER FORT PECK LAKE, MONTANA	
SUPERVISOR: J. E. M. & S. E. M.		SUMMARY OF FOUNDATION SETTLEMENT STATION 67+00	
APPROVED	APPROVED	DATE	
CHIEF FIELD ENGINEER	CHIEF ENGINEERING OFFICE	SCALE AS SHOWN	CHIEF OF DISTRICT
APPROVED	APPROVED	CHIEF OF DISTRICT	

CONSTRUCTION FOUNDATION REPORT

PLATE 18

2





LEGEND:
 ○ FILL HEIGHT IN FEET
 — SETTLEMENT IN FEET

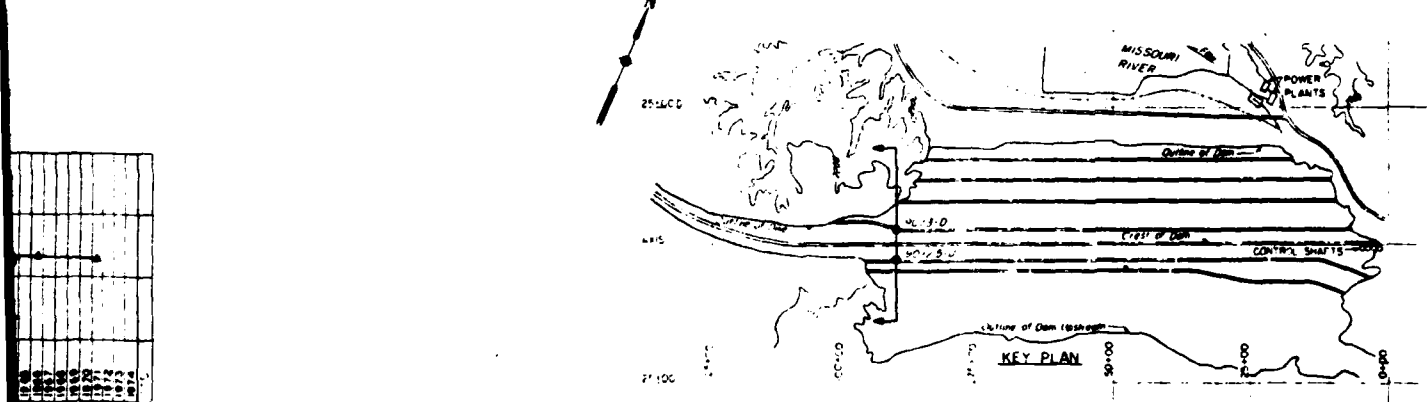
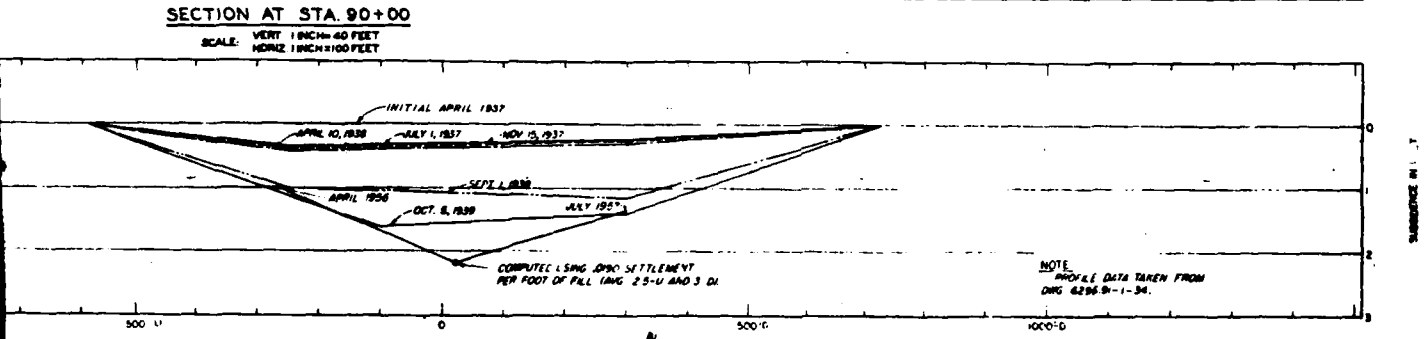
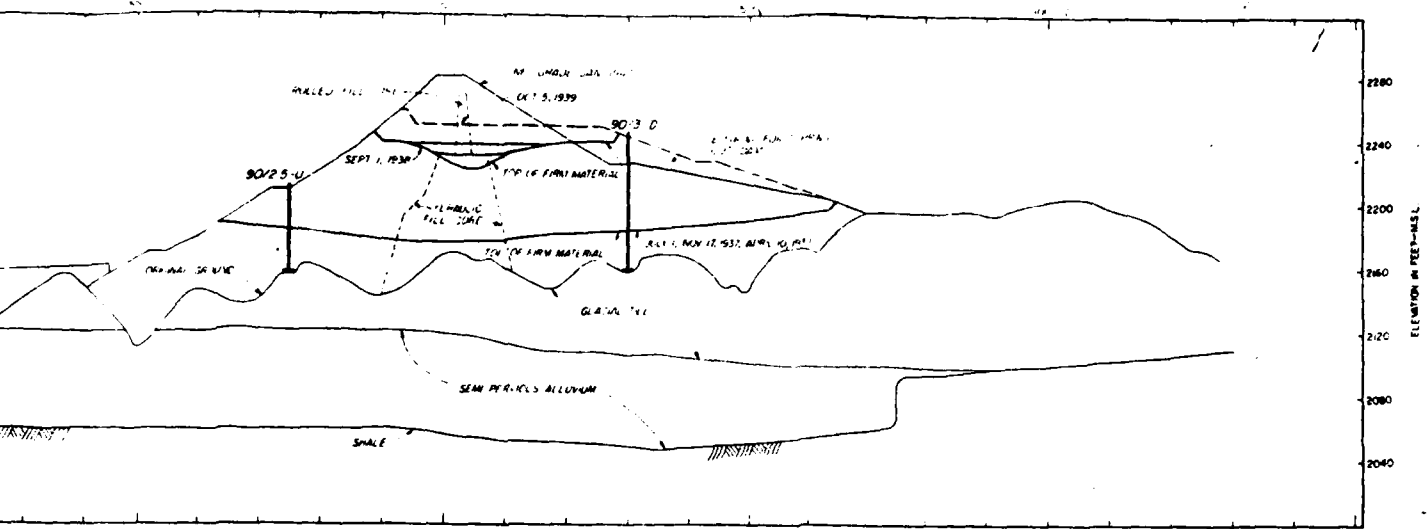
THIS DRAWING HAS BEEN REDUCED TO
 FORTY-EIGHTS THE ORIGINAL SCALE.

THIS PLAN ACCOMPANIES CONTRACT NO.
 MODIFICATION NO.



DATE	DESCRIPTION	MADE	APPROVED
DIVISION			
U. S. ARMY ENGINEER DISTRICT, OMAHA			
BUREAU OF ENGINEERS			
OMAHA, NEBRASKA			
MISSOURI RIVER			
FORT PECK LAKE, MONTANA			
SUMMARY OF FOUNDATION SETTLEMENT			
STATION 81+00			
DESIGNED BY	CHECKED BY	APPROVED BY	DATE
DRAWN BY	CHECKED BY	APPROVED BY	DATE
CONSTRUCTION BY	CHECKED BY	APPROVED BY	DATE
CONSTRUCTION BY	CHECKED BY	APPROVED BY	DATE

2



LEGEND

—○— SETTLEMENT IN FEET
 —○— FILL HEIGHT IN FEET

THIS DRAWING HAS BEEN REDUCED TO
 THREE-FIFTHS THE ORIGINAL SCALE.

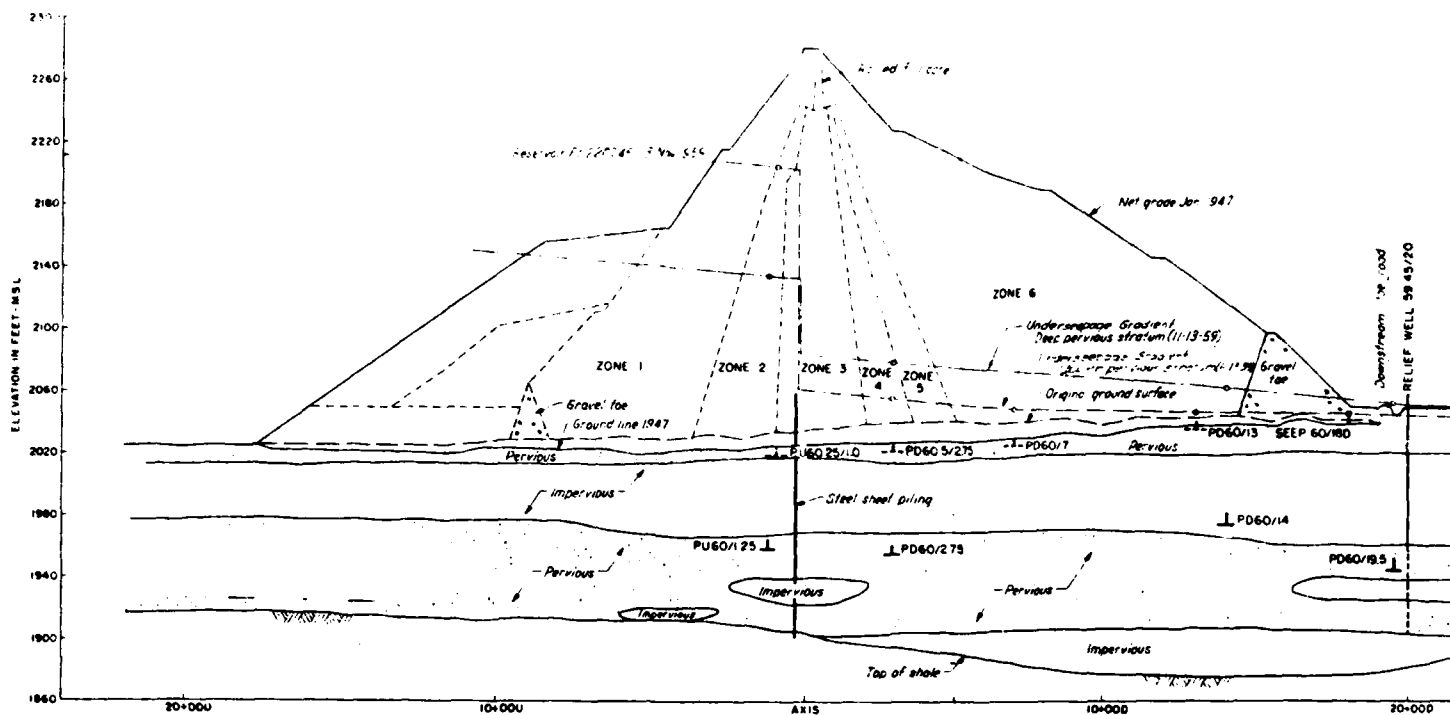
REVISIONS	
DATE	DESCRIPTION

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

MISSOURI RIVER
FORT PECK LAKE, MONTANA

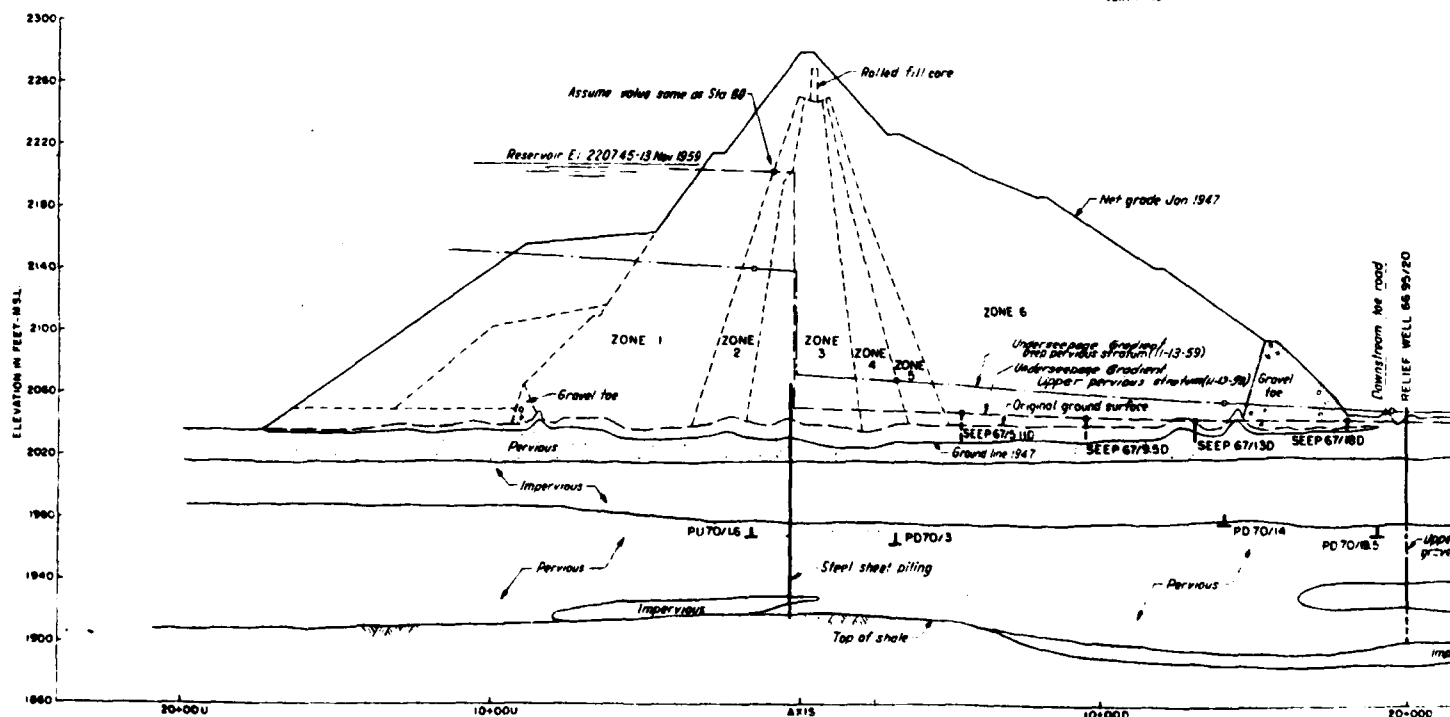
SUMMARY OF FOUNDATION SETTLEMENT
STATION 90+00

DESIGNED BY: W. J. M.	CHECKED BY: C. H. A.	APPROVED BY: [Signature]
DESIGNED BY: [Signature]	CHECKED BY: [Signature]	APPROVED BY: [Signature]
DESIGNED BY: [Signature]	CHECKED BY: [Signature]	APPROVED BY: [Signature]



SECTION-STA. 60+00

SCALE HOR 1"=100' VERT 1"=40'

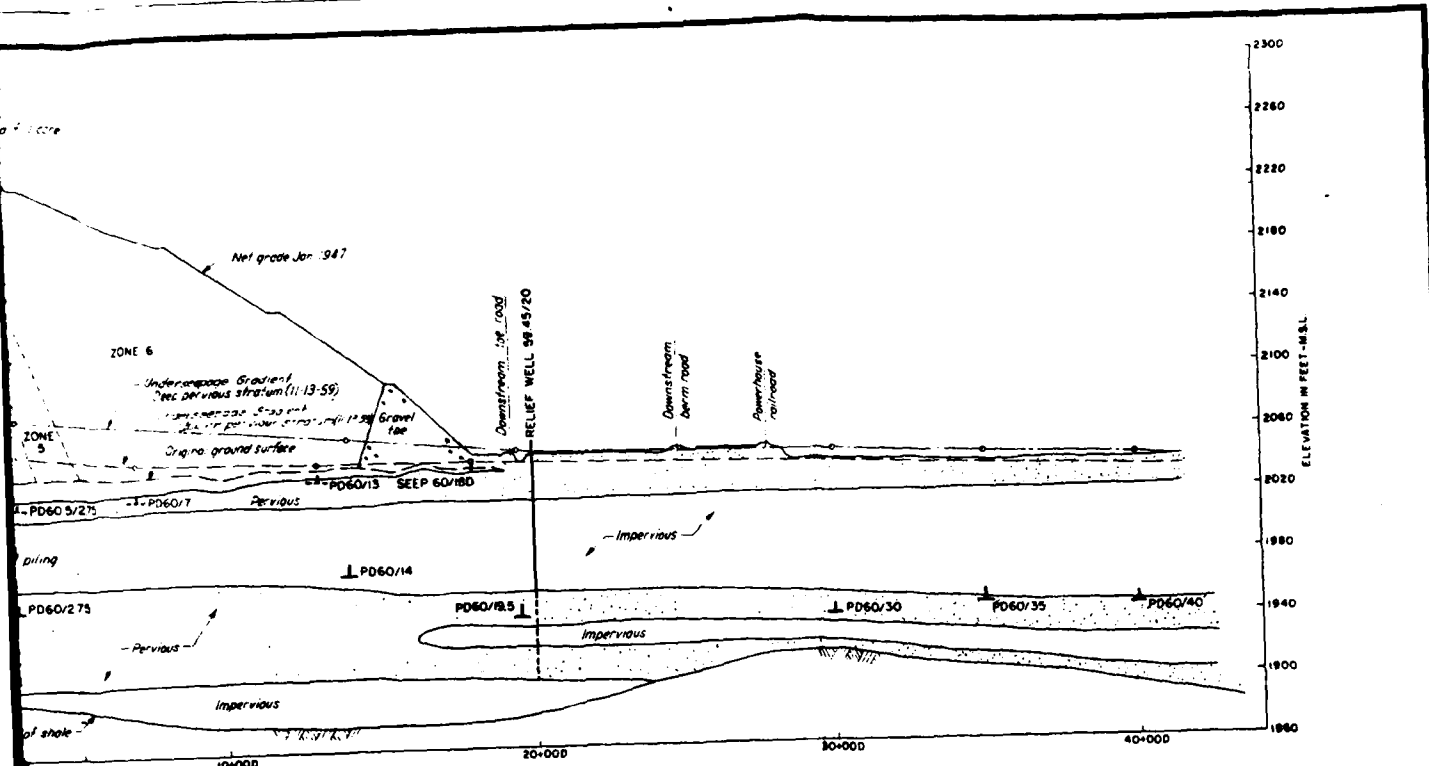


SECTION-STA. 67+00

SCALE HOR 1"=100' VERT 1"=40'

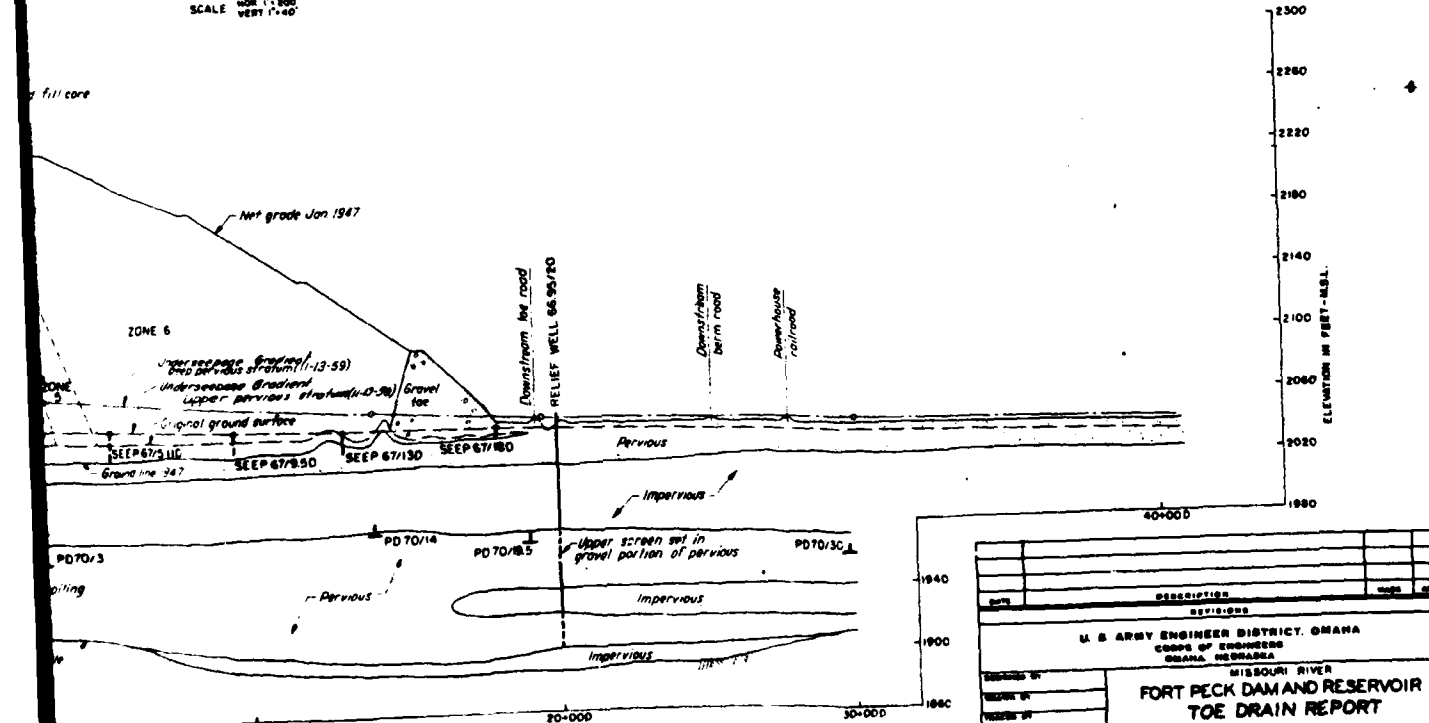
1. Bt
2. Bt
PD70/3 - P
SEEP 67/130 - S

1a
1b



SECTION-STA. 60+00

SCALE HOR. 1"=100' VERT. 1"=20'



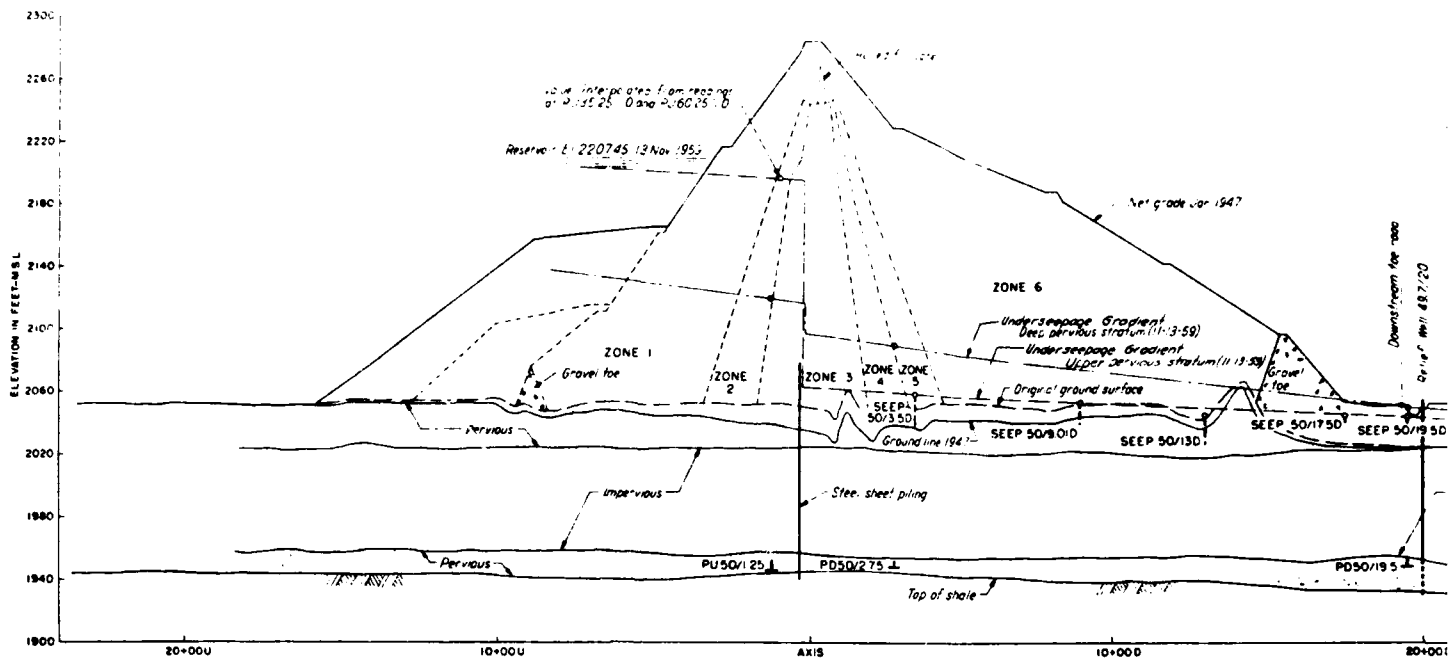
SECTION-STA. 67+00

SCALE HOR. 1"=100' VERT. 1"=20'

LEGEND
 — Bottom of Deep Piezometers
 — Bottom of Shallow Piezometers
 PD70/5 - Piezometer at Sta. 70+00, Range 3+00 Downstream
 SEEP 67/130 - Seepage Pipe at Sta. 67+00, Range 13+00 Downstream
 This drawing has been reduced to 1/2 inch scale for printing.

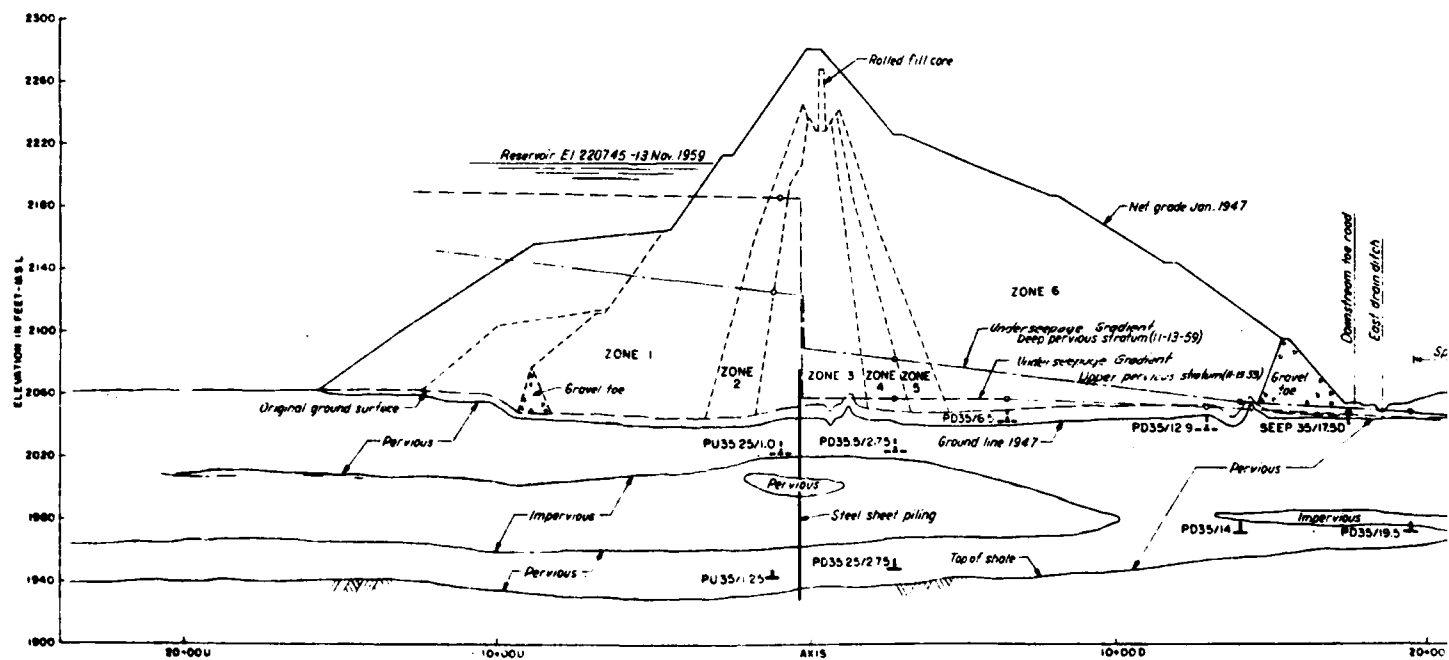
U. S. ARMY ENGINEER DISTRICT, OMAHA	
CORPS OF ENGINEERS	
OMAHA, NEBRASKA	
MISSOURI RIVER	
FORT PECK DAM AND RESERVOIR	
TOE DRAIN REPORT	
SECTIONS AT STA 60+00 AND STA 67+00	
SOIL PROFILE AND UNDERSEEPAGE GRADIENTS	
DESIGNED BY	DATE
DRAWN BY	DATE
CHECKED BY	DATE
APPROVED BY	DATE
PROJECT NO.	DATE
SCALE	DATE

2



SECTION-STA 50+00

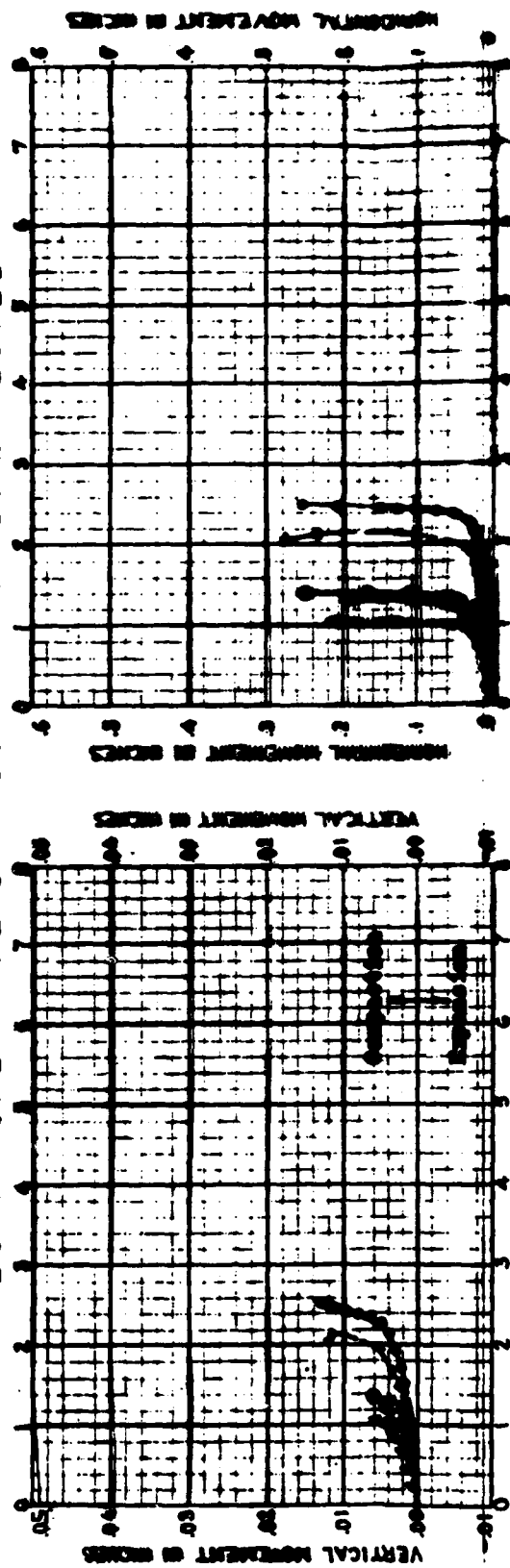
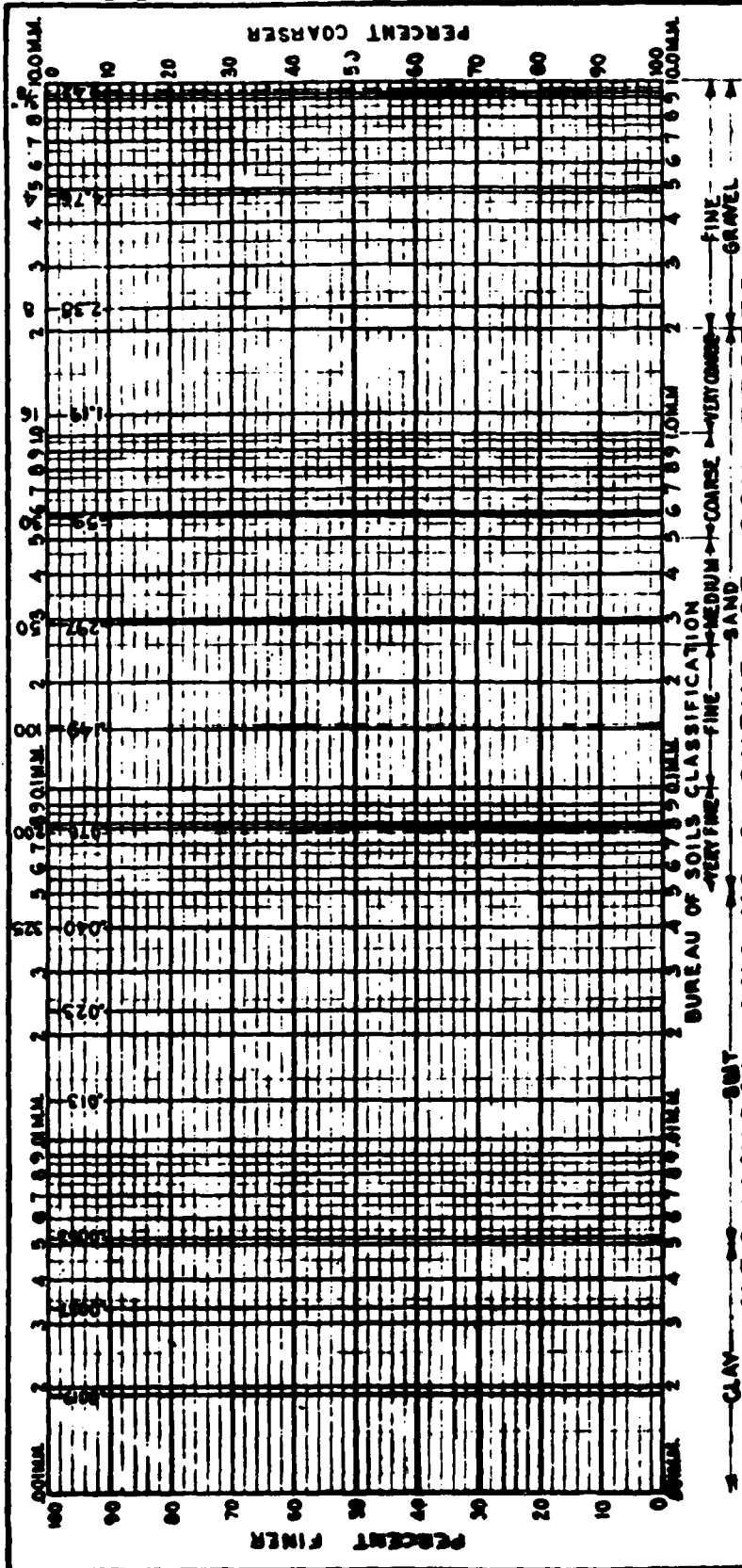
SCALE HOR 1"=200'
VERT 1"=40'

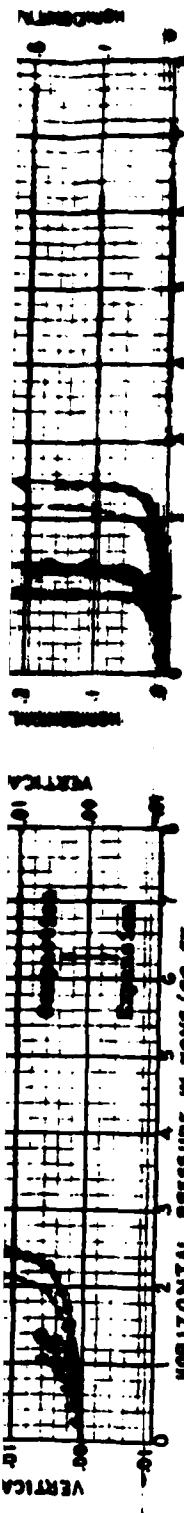


SECTION-STA 35+00

SCALE HOR 1"=200'
VERT 1"=40'

1
- 1 -
PD 35/
SEEP 35/





HORIZONTAL PRESSURE IN TONS/SQ. FT.
VERTICAL AND HORIZONTAL MOVEMENT CURVES DURING TEST



VERTICAL LOAD-TONS/SQ. FT.
NORMAL LOAD-SHEARING RESISTANCE CURVE

LEGEND-M.C.

Before Test	○
After Test	△
Undisturbed	⊖

LEGEND

△	— 5 7/16.00.
□	— 6 7/16.00.
○	— 10 7/16.00.
+	— 15 7/16.00.
●	— 15 7/16.00.

MOISTURE CONTENT
PERCENT DRY WEIGHT

SHEARING RESISTANCE TONS/SQ. FT.

Notes:
 Shearing Resistance
 $\Delta \sigma_g = \frac{\text{Cohesion (tons/sq. ft.)}}{\text{Vertical Load (tons/sq. ft.)}}$
 $= 0.186$
 $\phi = 6^\circ 50'$
 $c = \text{Cohesion} = 0.80 \text{ t/sq. ft.}$

MIS. O'RI RIVER IMPROVEMENT
 NAVIGATION, FLOOD CONTROL, POWER, IRRIGATION
FORT PECK DAM
 SLIDE INVESTIGATION
 CONSOLIDATED SHEAR TESTS - SERIES #1
 BENTONITE PUMP GROUT DRIFT
 TEST NO. 1-27-39
 DATE: 1-27-39
 BY: [Signature]
 CHECKED: [Signature]
 APPROVED: [Signature]
 TITLE: [Blank]
 NAME: [Blank]
 NO.: [Blank]

2

LEGEND

Δ	YOUNG/MG. FT.
\square	YOUNG/MG. FT.
\circ	YOUNG/MG. FT.
γ	YOUNG/MG. FT.
\bullet	YOUNG/MG. FT.
\cdot	YOUNG/MG. FT.

Indicated Sample from Martins Drift above Joint Portals
 Quick Shear Tests
 Moisture content of Shales 17.5% (over four trials)
 Moisture content of Bentonite = 41.5% (over four trials)
 Sample Immersed in water during test.
 Initial Thickness of Sample 1.00 in.
 Gross Sectional Area of Sample 16.00 sq. in.

Scale 0.10 in.
 1 in. = 10 in.
 or 0.50 in. = 5 in.

10 11 12 13 14 15

MISSOURI RIVER IMPROVEMENT

FORT PECK DAM

SLIDE INVESTIGATION
 QUICK SHEAR TESTS SERIES # 1
 BENTONITE STRAIN ON SPECIMEN NO. 127-10

U. S. ENGINEER OFFICE, FORT PECK, MONTANA
Section:
Approved Recommended: Approved:
Drawn by: Checked by: Initials: Date: 12/27/30
12/27/30

VERTICAL LOAD - TEN PER SQ. FT.
 HORIZONTAL MOVEMENT IN INCHES

Results of tests on undisturbed samples of shale taken in the Fort Peck Dam Foundation, downstream, with 6-inch sampler

1	2	3	4	5	6	7	8	9
Sample No.	Sam. or-burden	Depth into shale	Equivalent load in tons/sq. ft.	Moisture content, percent dry weight	Shearing strength in tons/sq. ft.	Computed shearing strength tons/sq. ft. with $T_{90} = .18$, $C = .28$	Ratio $\frac{6}{7}$	Type test
HOLE C-12 STATION 10+73, RANGE 8+00 D								
6.....	14.6	1.4	0.85	31.3	0.45	0.35	1.85	Quick.
7.....	14.6	2.4	.97	23.8	.95	.37	2.32	Consol.
8.....	14.6	3.4	1.00	23.3	.85	.40	2.2	Quick.
9.....	14.6	7.4	1.21	20.6	.81	.42	1.90	Quick.
HOLE C-13 STATION 12+00, RANGE 8+00 D								
2.....	20.5	0.0	1.20	26.0	1.35	0.43	2.9	Quick.
3.....	20.5	0.0	1.20	27.7	1.05	.43	2.5	Consol.
4.....	20.5	2.0	1.41	45.8	.94	.45	2.1	Quick.
5.....	20.5	4.0	1.50	26.0	2.00	.40	4.3	Quick.
6.....	20.5	6.0	1.05	25.5	1.15	.30	2.3	Quick.
7.....	20.5	8.0	1.05	26.0	1.35	.30	2.1	Consol.
8.....	20.5	10.4	1.00	25.0	1.25	.54	2.2	Quick.
9.....	20.5	12.0	2.01	20.0	1.25	.30	2.3	Quick.
HOLE C-14 STATION 12+00, RANGE 8+00 D								
2.....	65.3	1.7	2.44	20.0	2.25	0.60	3.5	Quick.
3.....	65.3	2.7	2.00	24.5	1.30	.67	1.9	Consol.
4.....	65.3	5.7	2.72	21.2	2.4	.60	2.5	Quick.
5.....	65.3	7.7	2.04	20.2	1.90	.71	2.7	Quick.
6.....	65.3	10.3	2.18	22.5	1.50	.77	1.85	Quick.
HOLE C-15 STATION 13+25, RANGE 8+00 D								
2.....	72.5	2.0	3.87	25.5	1.30	0.90	1.55	Quick.
3.....	72.5	3.5	3.00	25.7	1.31	.82	1.64	Consol.
4.....	72.5	7.75	4.21	25.5	2.50	.85	2.7	Quick.
7.....	72.5	11.75	4.46	26.0	2.05	1.05	1.90	Quick.
HOLE C-16, STATION 14+00, RANGE 8+00 D								
2.....	100	1.0	5.70	27.7	2.50	1.25	2.01	Quick.
3.....	100	2.0	5.00	27.1	3.00	1.20	2.40	Consol.
4.....	100	7.0	6.36	25.5	1.00	1.30	1.45	Quick.
TEST SHAFT, STATION 10+00, RANGE 8+00 D								
0.....	20.5	1.5	1.35	25.1	0.75	0.45	1.64	Quick.
1.....	20.5	1.5	1.35	24.1	.90	.44	2.13	Quick.
2.....	20.5	4.5	1.75	25.2	1.44	.43	2.77	Quick.
GLACIAL TILL FROM HOLE AT STATION 100+00, RANGE 8+00 D								
2.....	65.3	2.5	2.24	18.7	1.30	0.80	1.64	Quick.
3.....	65.3	5.5	4.40	10.4	1.50	.80	1.82	Quick.
5.....	65.3	7.5	2.30	25.4	1.40	.80	1.57	Consol.
6.....	65.3	9.5	2.70	27.3	1.04	.80	1.57	Quick.

¹ After test.

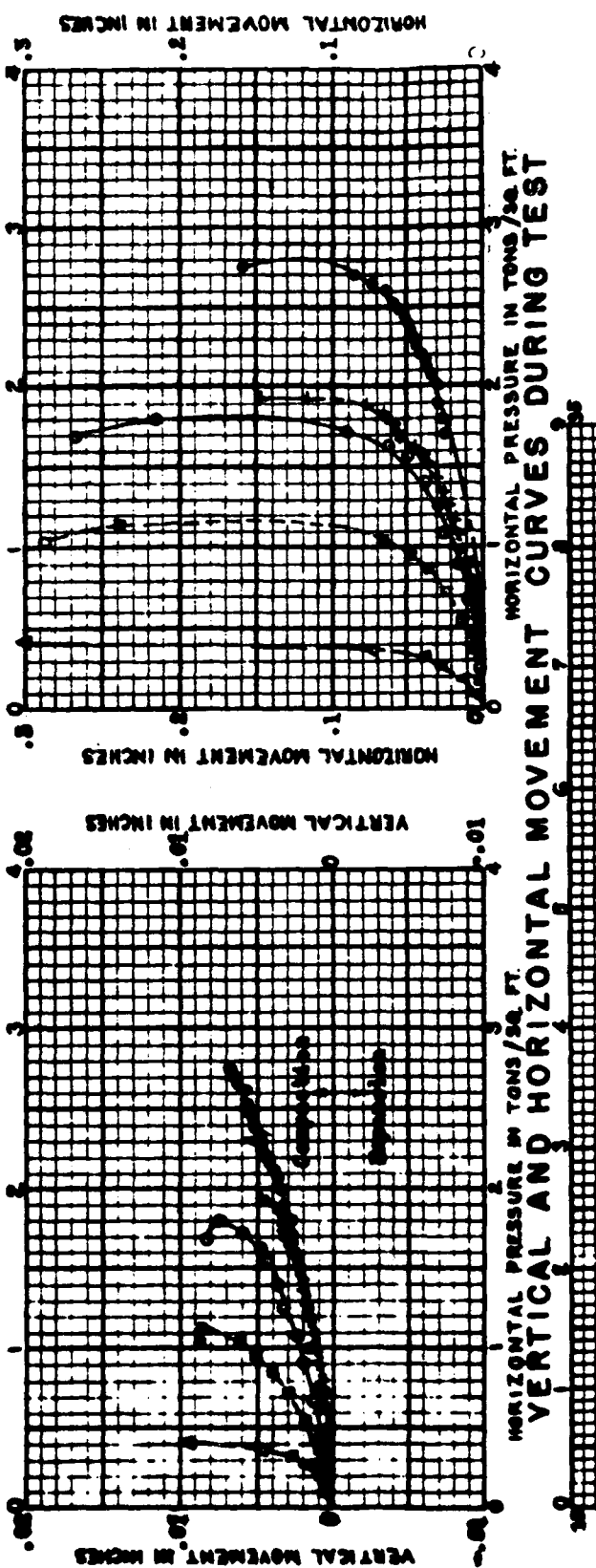
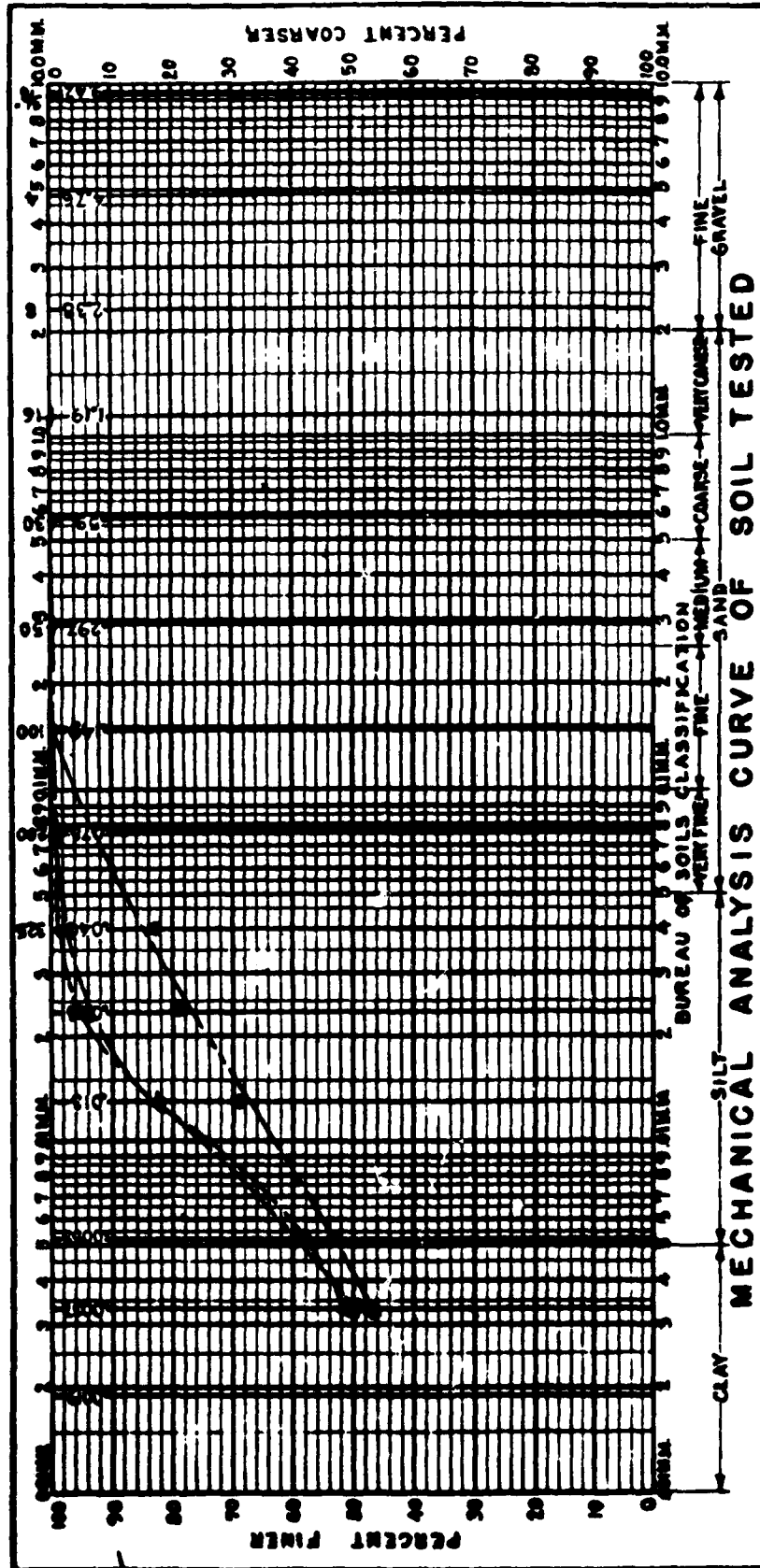
Notes.— Except for samples 1 and 2 from the test shaft all samples were 6" drive samples.

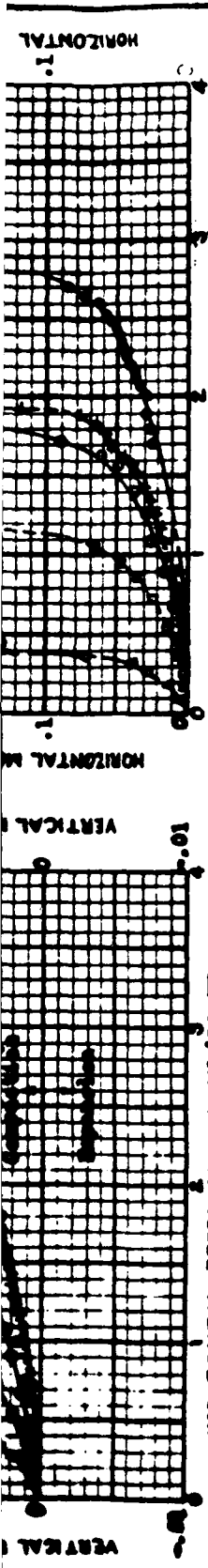
Duration of test for Quick shear varied from 1.5 to 3 minutes.

The vertical load for the duration of the test was as indicated in Column 4.

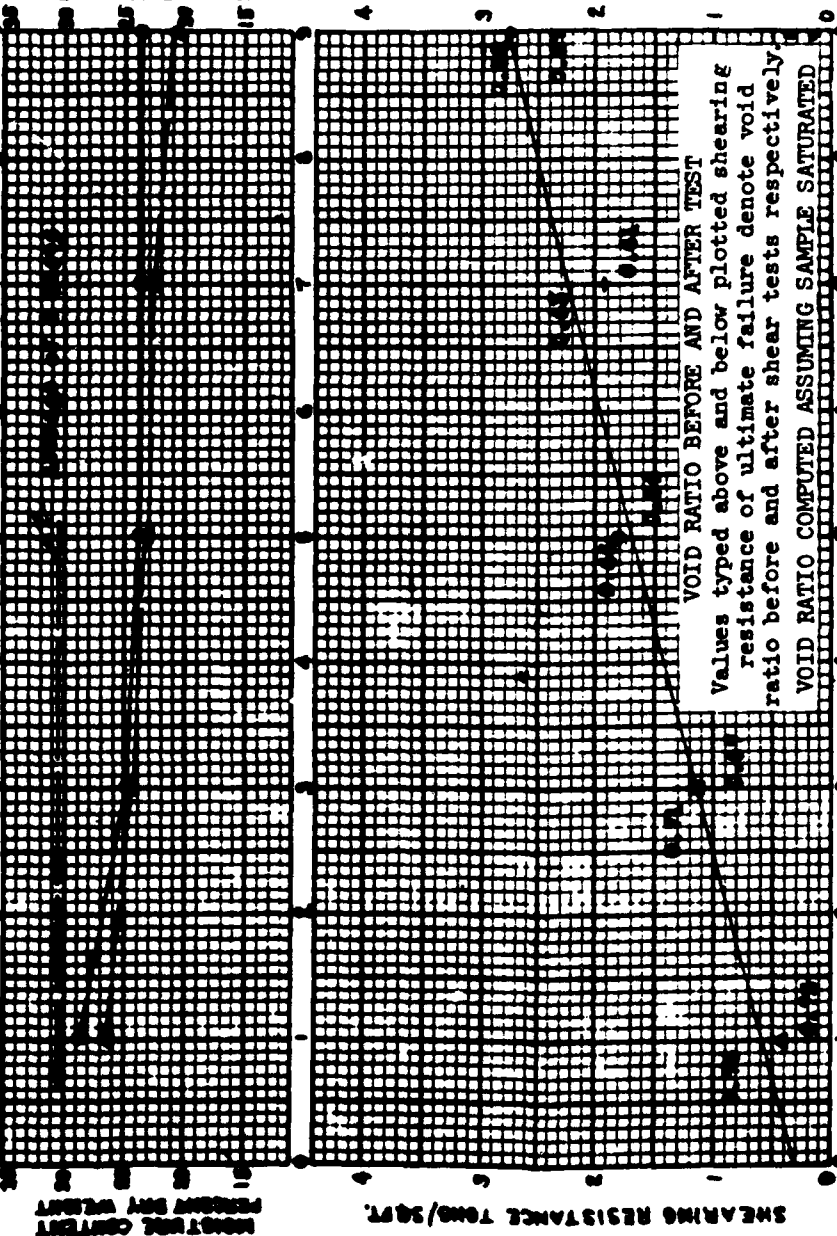
The $\phi = 0.18$, $C = 0.28$ were coefficients used in the design of the reconstruction in the slide area.

For computed shearing strength for Glacial Till from Hole S. D. No. 95 coefficients used were $T_{90} = .25$, $C = .32$.





HORIZONTAL PRESSURE IN TONS/SQ. FT.
VERTICAL AND HORIZONTAL MOVEMENT CURVES DURING TEST



VERTICAL LOAD TONS/SQ. FT.
NORMAL LOAD-SHEARING RESISTANCE CURVE

MOISTURE CONTENT
 PERCENT DRY WEIGHT

LEGEND-M.C.	
Before Test	○
After Test	△
Undisturbed	□

SHEARING RESISTANCE TONS/SQ. FT.

LEGEND	
△	1 T/4 ft.
□	3 T/4 ft.
○	5 T/4 ft.
+	7 T/4 ft.
●	9 T/4 ft.

VOID RATIO BEFORE AND AFTER TEST
 Values typed above and below plotted shearing resistance of ultimate failure denote void ratio before and after shear tests respectively.
 VOID RATIO COMPUTED ASSUMING SAMPLE SATURATED

Notes: Undisturbed Sample

- Consolidated Shear Tests
- Increment Loading
- Elevation 2115.0 - 2114.0
- Depth 0.0 - 1.0
- Gross Sectional Area of Sample 16.00 Sq. In.
- Initial Thickness 0.75 inch
- Sample immersed in water during test
- Station 13 / 5 Range 14 / 50

Shearing Resistance

Consolidated Shear Tests

Increment Loading

Elevation 2115.0 - 2114.0

Depth 0.0 - 1.0

Gross Sectional Area of Sample 16.00 Sq. In.

Initial Thickness 0.75 inch

Sample immersed in water during test

Station 13 / 5 Range 14 / 50

c = Cohesion = 0.80 T/4 ft.

φ = 15° 25'

MISSOURI RIVER IMPROVEMENT
 NAVIGATION, FLOOD CONTROL, POWER, IRRIGATION

FORT PECK DAM

SLIDE INVESTIGATION
 SHEAR TESTS ON UNDISTURBED SAMPLES OF
 DISTURBED WEATHERED SHALE

U.S. ENGINEER OFFICE, FORT PECK, MONT 1-4-39

Approved Recommended

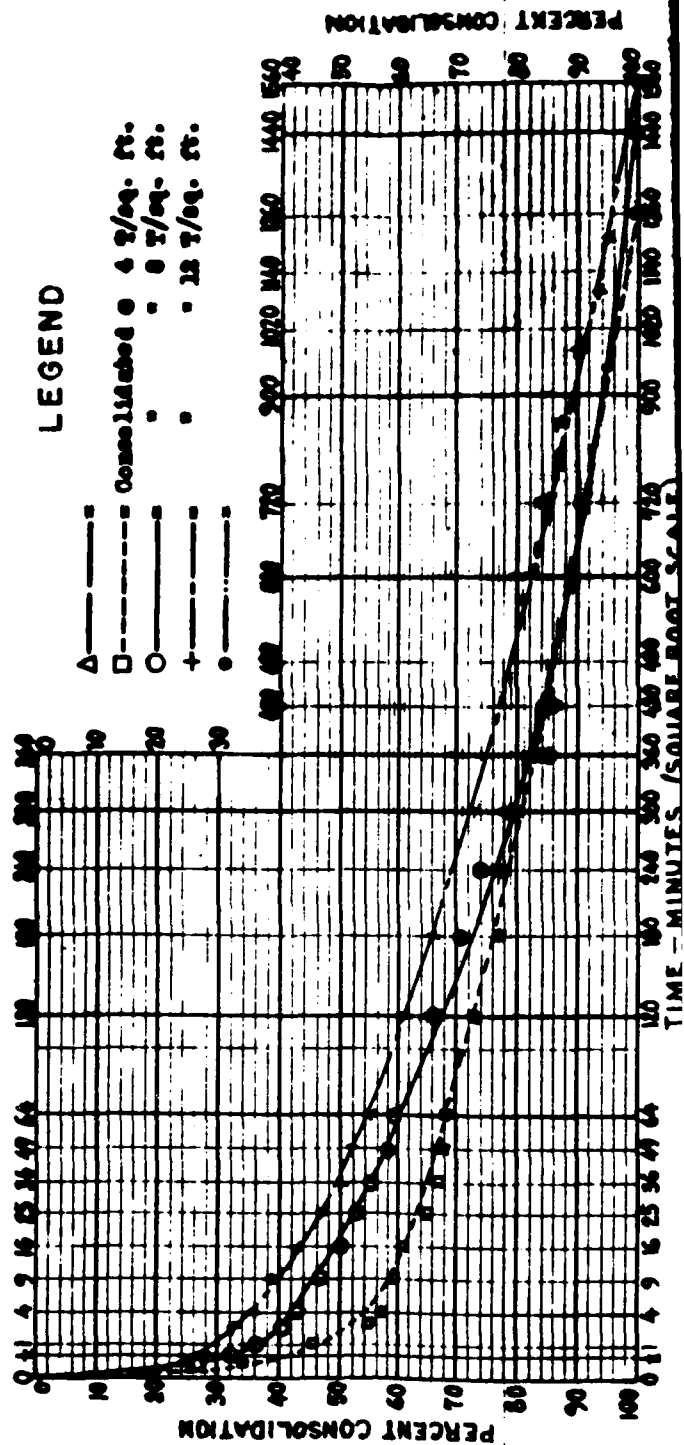
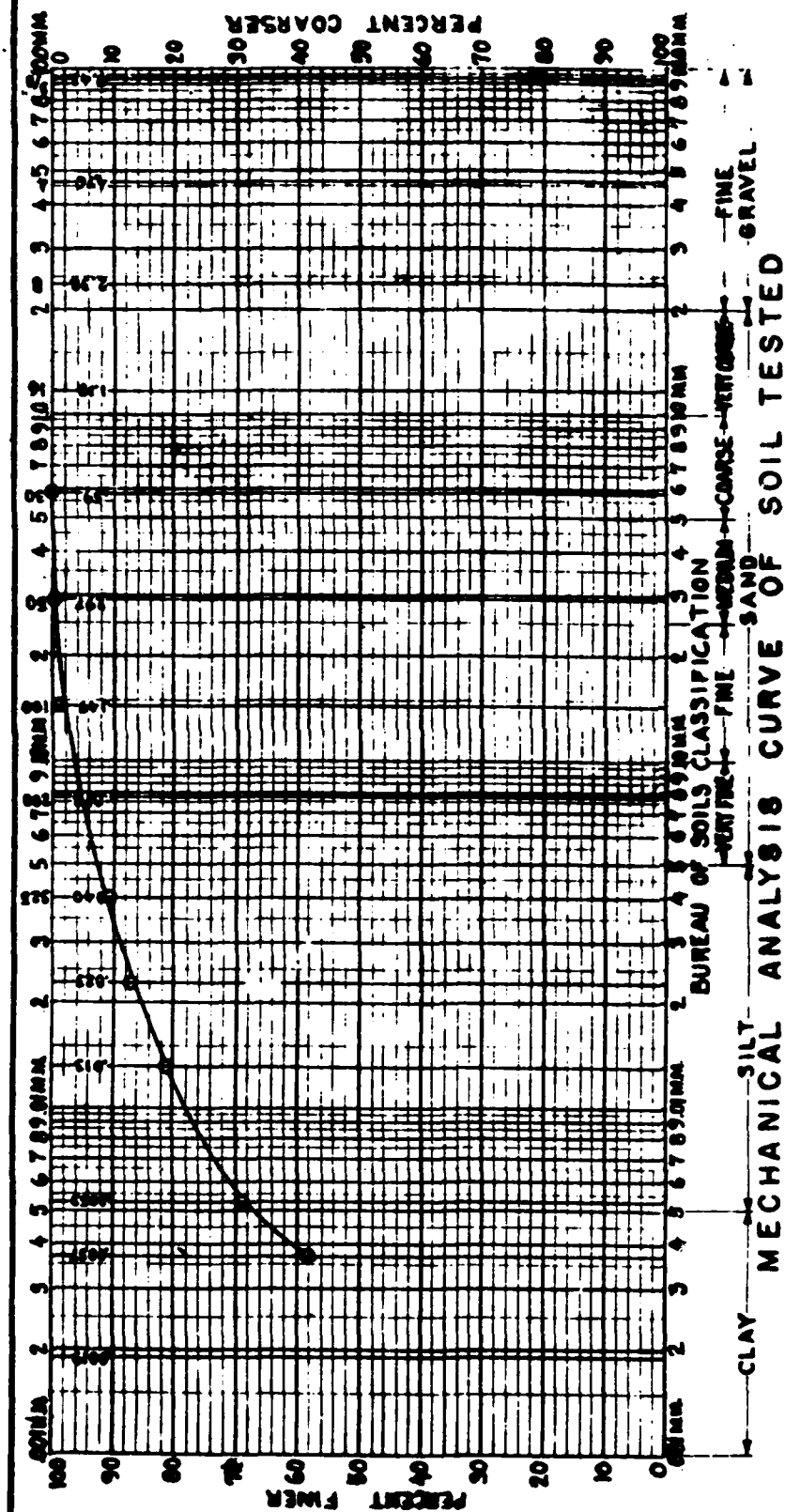
Checked by

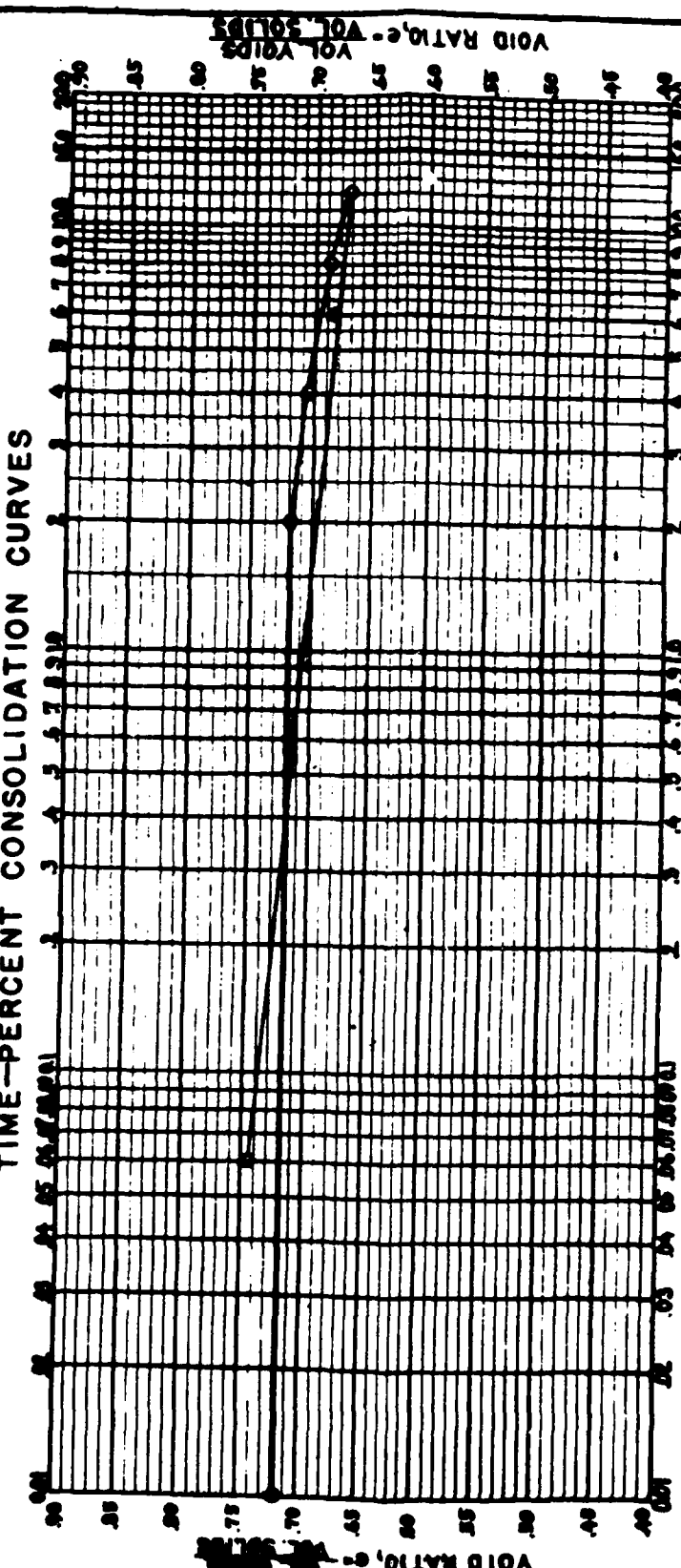
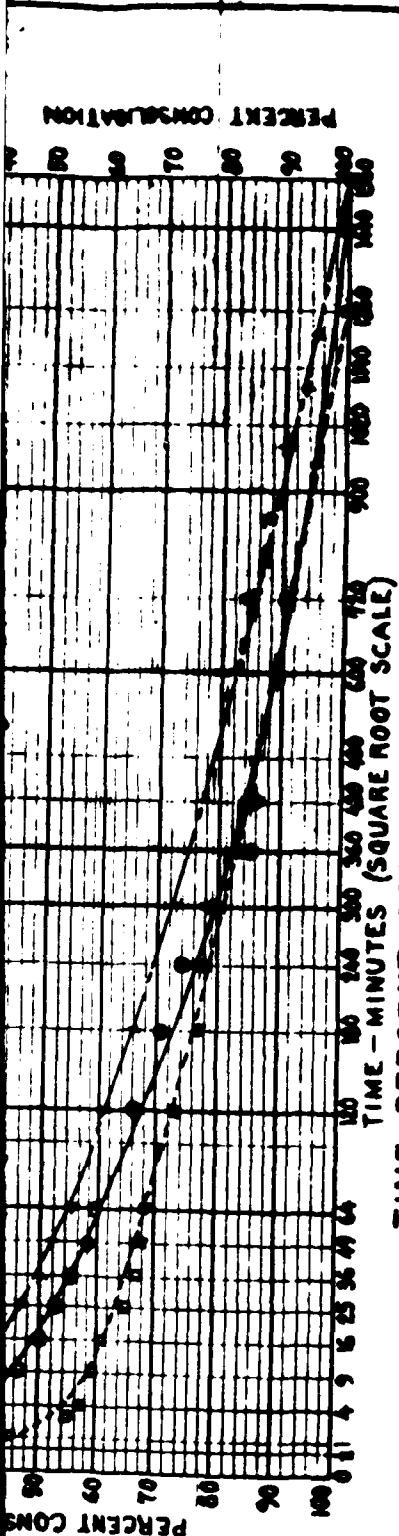
Transmitted with report

File No

7/13 EBC

7/13 EBC





PRESSURE-VOID RATIO CURVE
 Estimated Previous Consolidation = Tons/Sq. Ft.
 Undisturbed sample of Weathered shale from
 Kerriman Drift above Inlet Portals.
 Immersed in Water during Test.
 Initial Thickness 1.25 inches.
 Gross Sectional Area 24.80 sq. in.

VERTICAL LOAD TONS/SQ. FT.	COMPACTION PERCENTS
0.00	0.00
2.00	0.08
4.00	0.80
8.00	1.84
12.00	2.04
6.00	2.24
0.07	- 1.89

MISSOURI RIVER IMPROVEMENT
 NAVIGATION, FLOOD CONTROL, POWER, IRRIGATION
FORT PECK DAM
 SLIDE INVESTIGATION
 CONSOLIDATION TEST WEATHERED SHALE
 KERRIMAN DRIFT; SAMPLE #1
 U.S. ENGINEER OFFICE, FORT PECK, MONT. 1-89-86

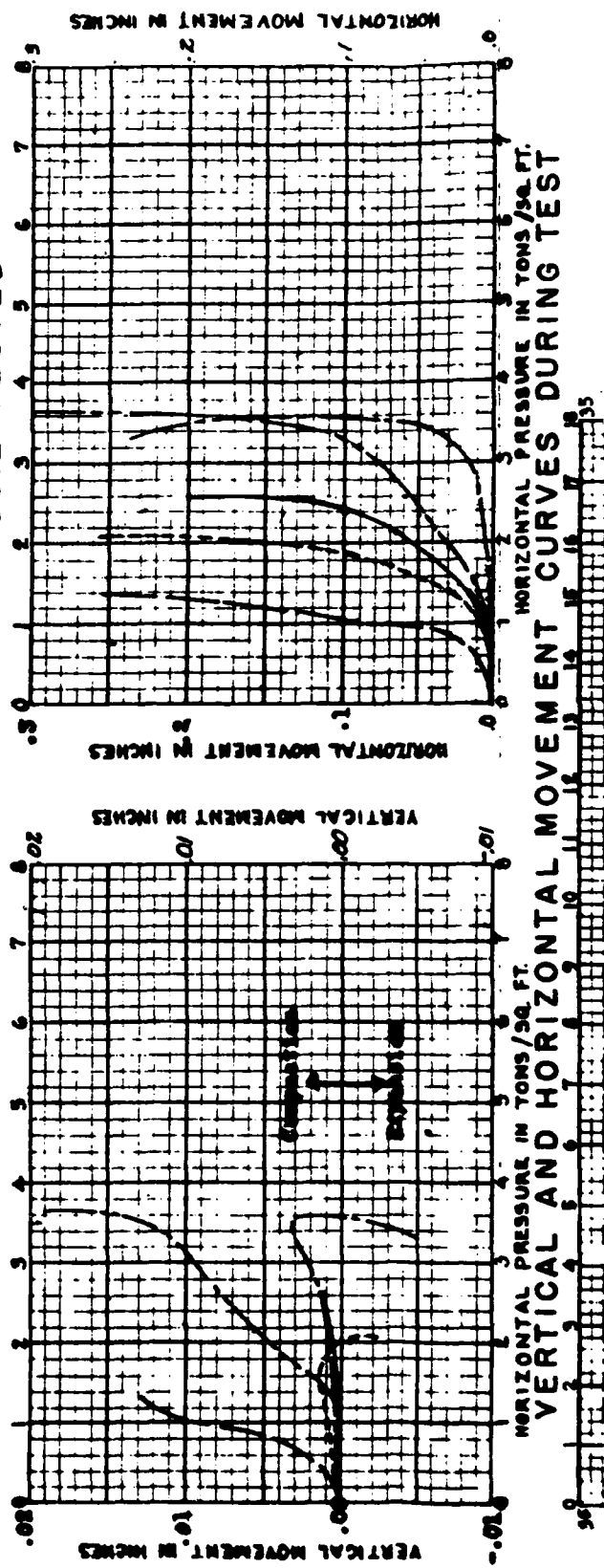
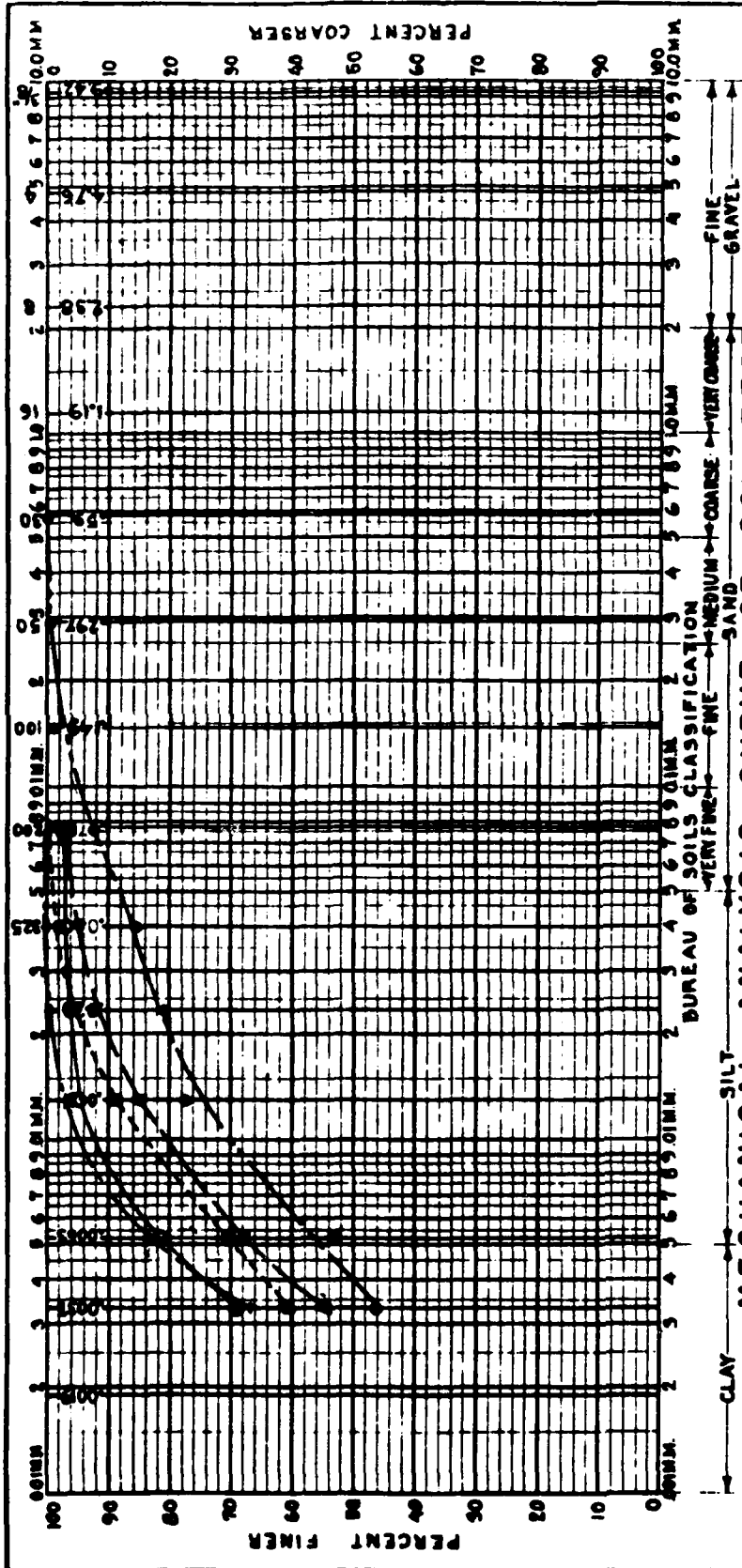
Submitted: _____
 Checked by: _____
 Drawn by: _____
 File No. _____

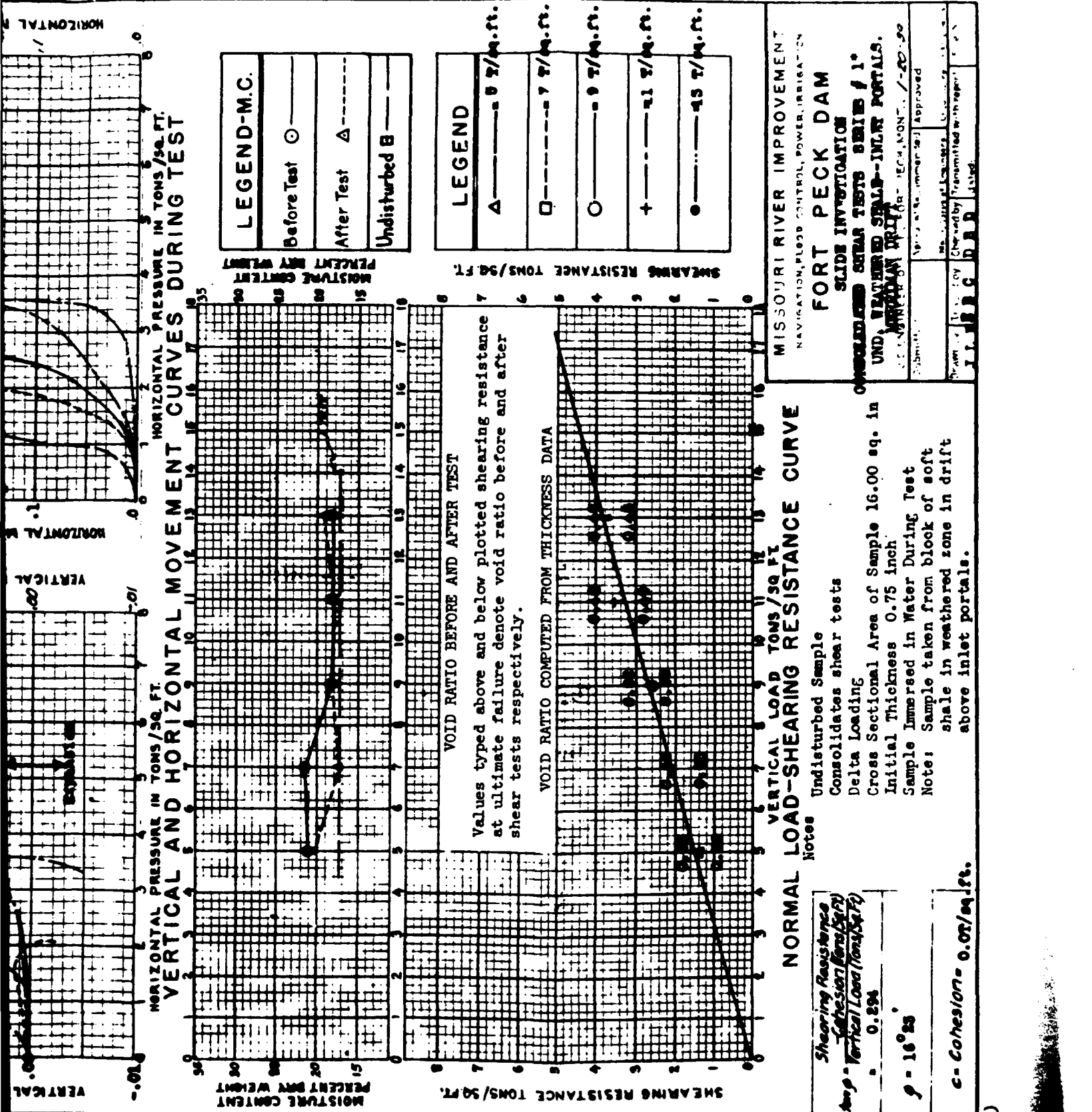
Approval Recommended Approved

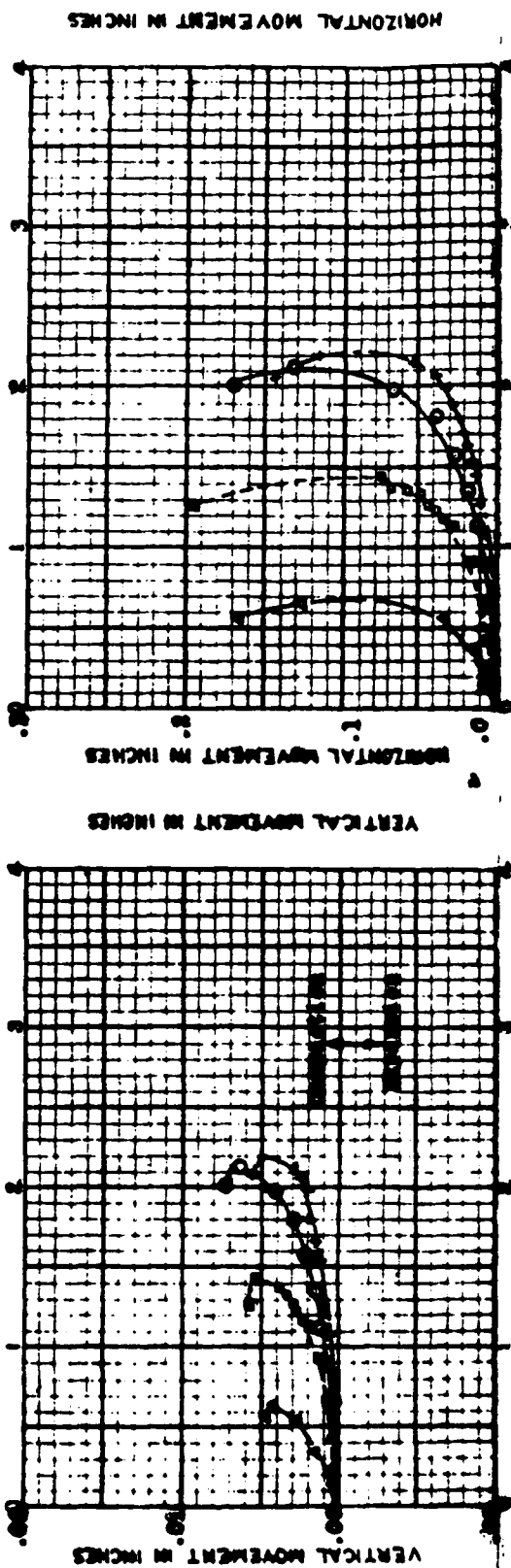
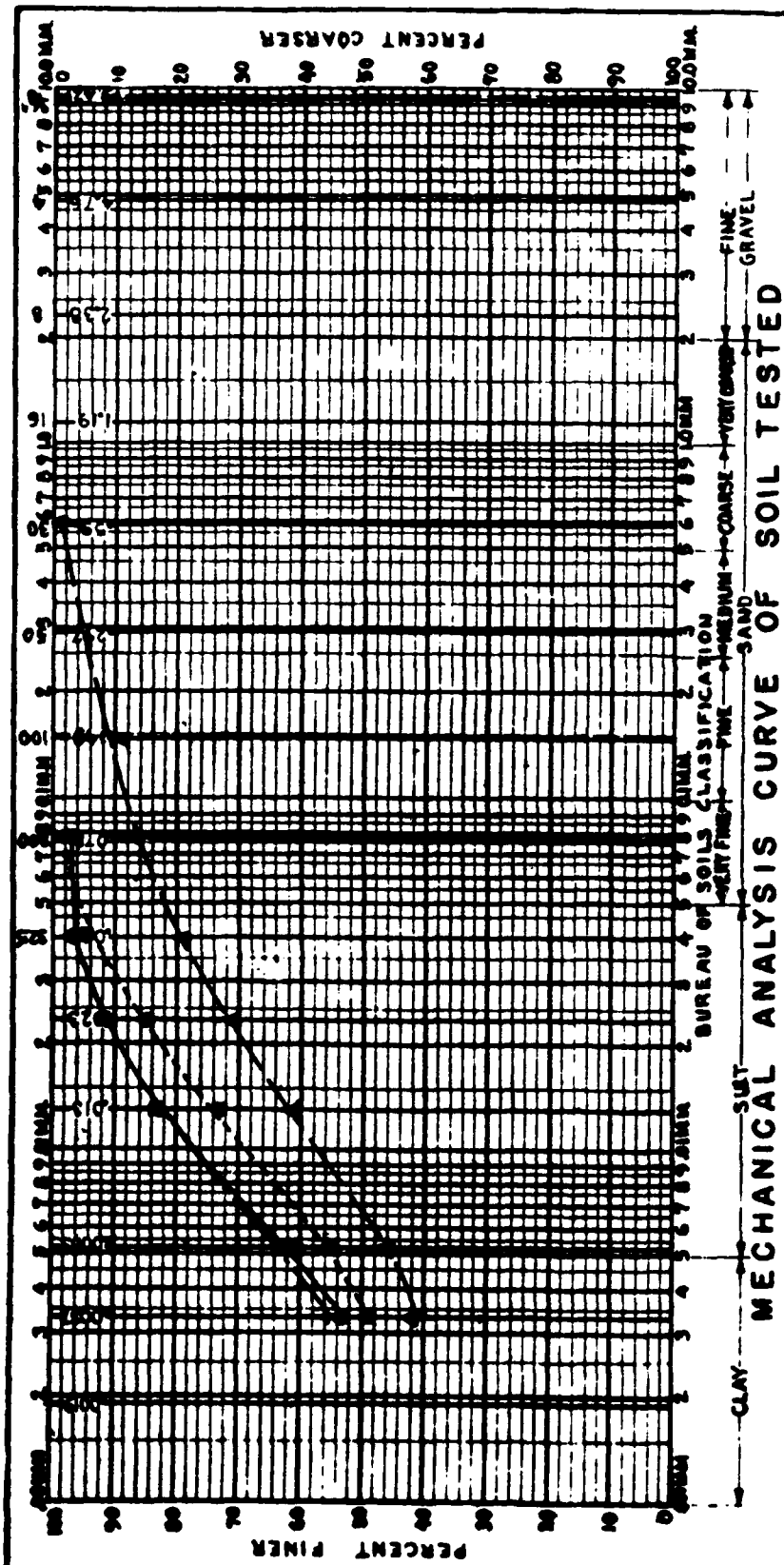
U.S. ENGINEER OFFICE, FORT PECK, MONT. 1-89-86

Submitted: _____
 Checked by: _____
 Drawn by: _____
 File No. _____

Total compaction in percent of original height of sample.

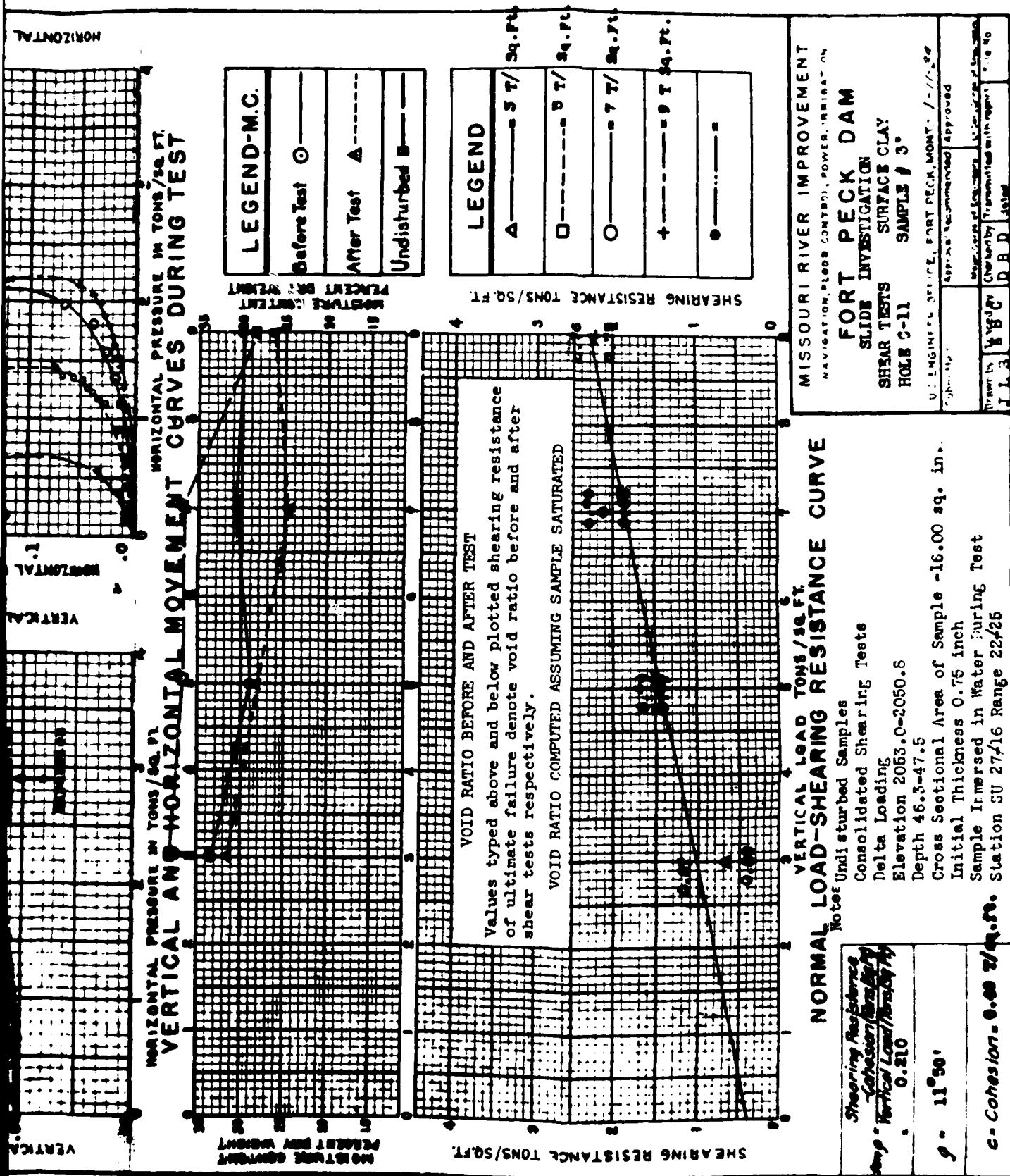






HORIZONTAL PRESSURE IN TONS/SG. FT.

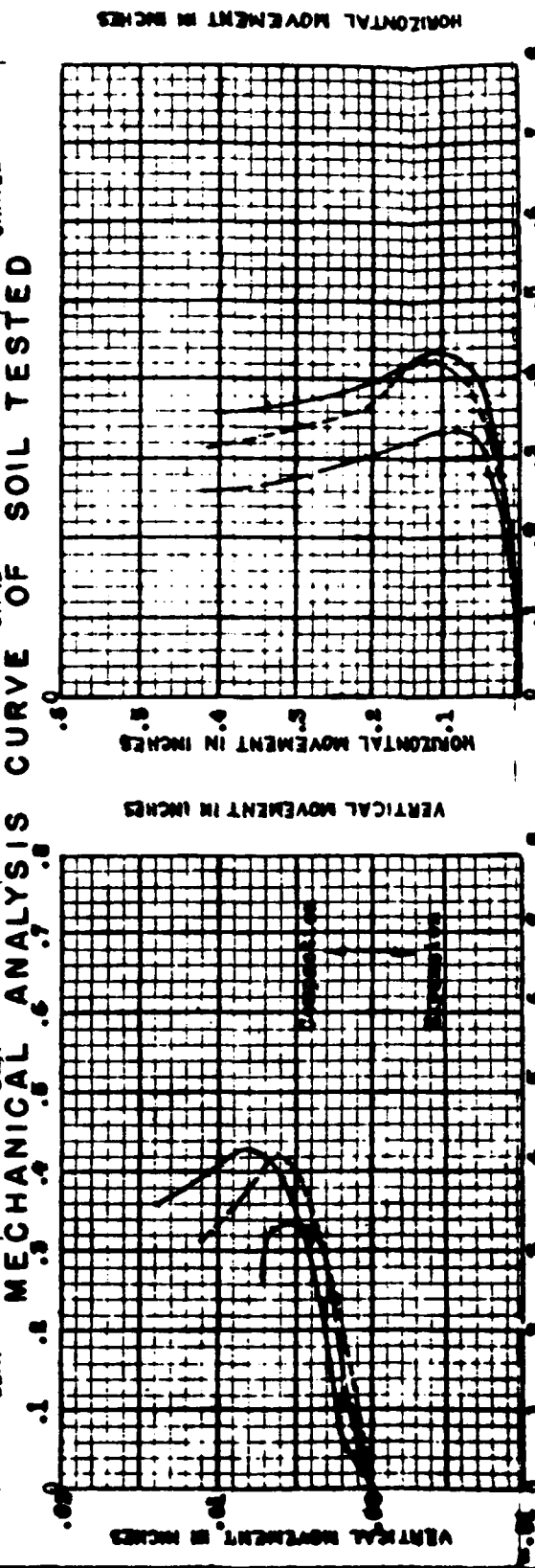
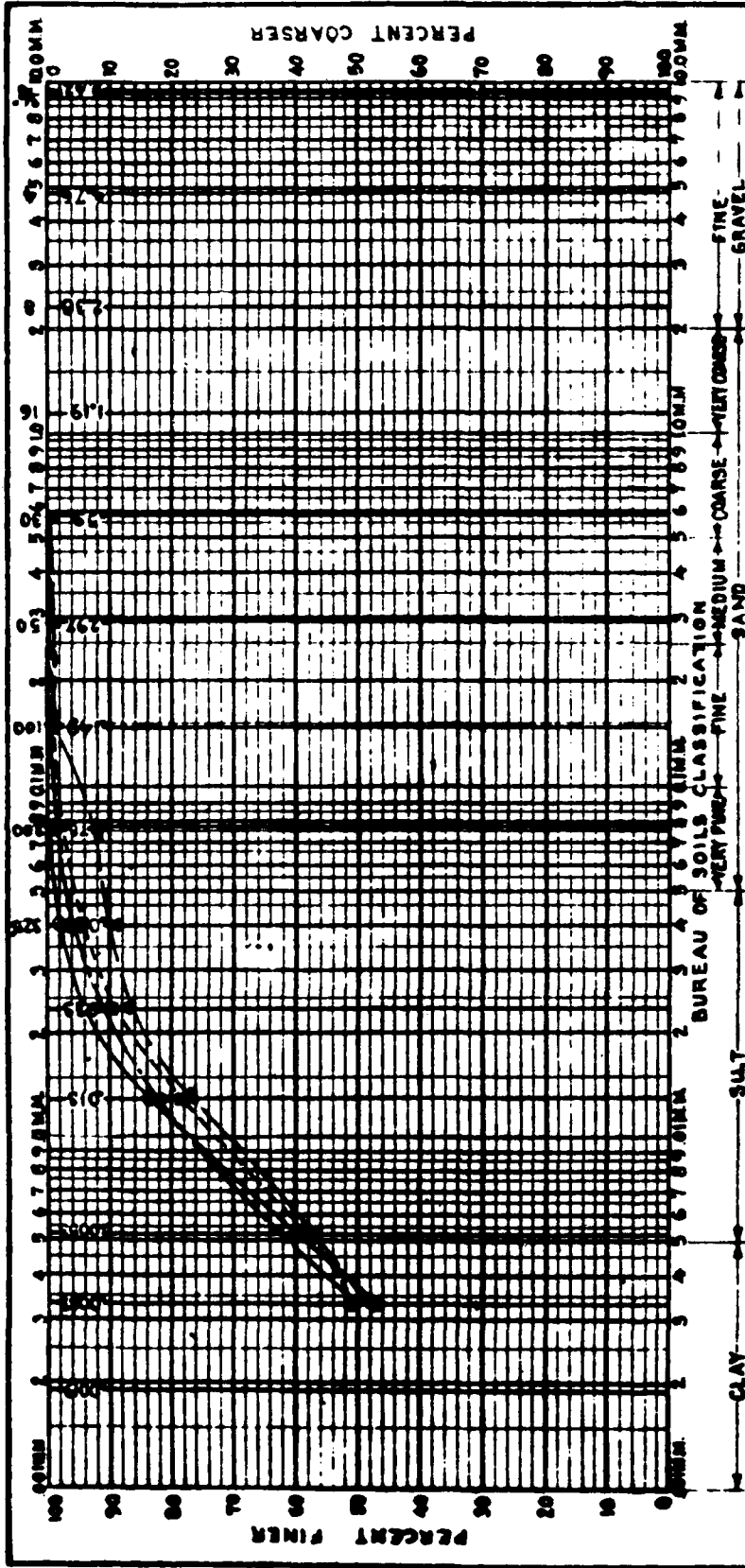
VERTICAL AND HORIZONTAL MOVEMENT CURVES DURING TEST



MISSOURI RIVER IMPROVEMENT
 NAVIGATION, FLOOD CONTROL, POWER, IRRIGATION

FORT PECK DAM
 SLIDE INVESTIGATION
 SHEAR TESTS SURFACE CLAY
 HOLE C-11 SAMPLE # 3

U.S. ENGINEERING OFFICE, FORT PECK, MONT. 1-11-50
 Approved: [Signature]
 Recommended: [Signature]
 Prepared by: [Signature]
 Checked by: [Signature]
 Drawn by: [Signature]
 Date: 11/3/50



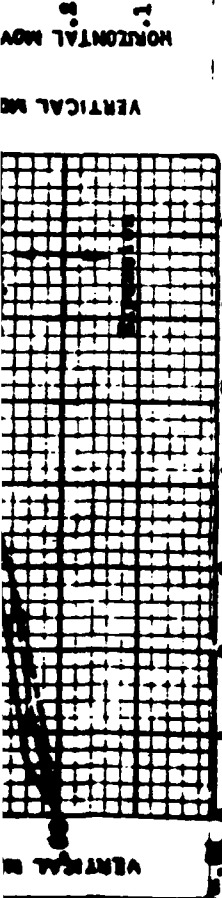
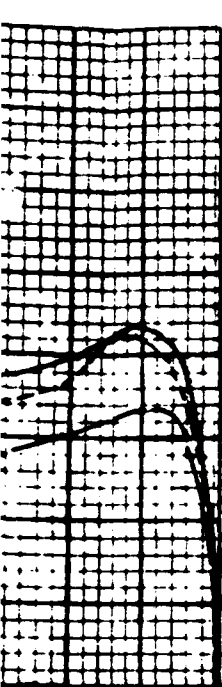
VERTICAL AND HORIZONTAL MOVEMENT CURVES DURING TEST

HORIZONTAL PRESSURE IN TONS/50 FT

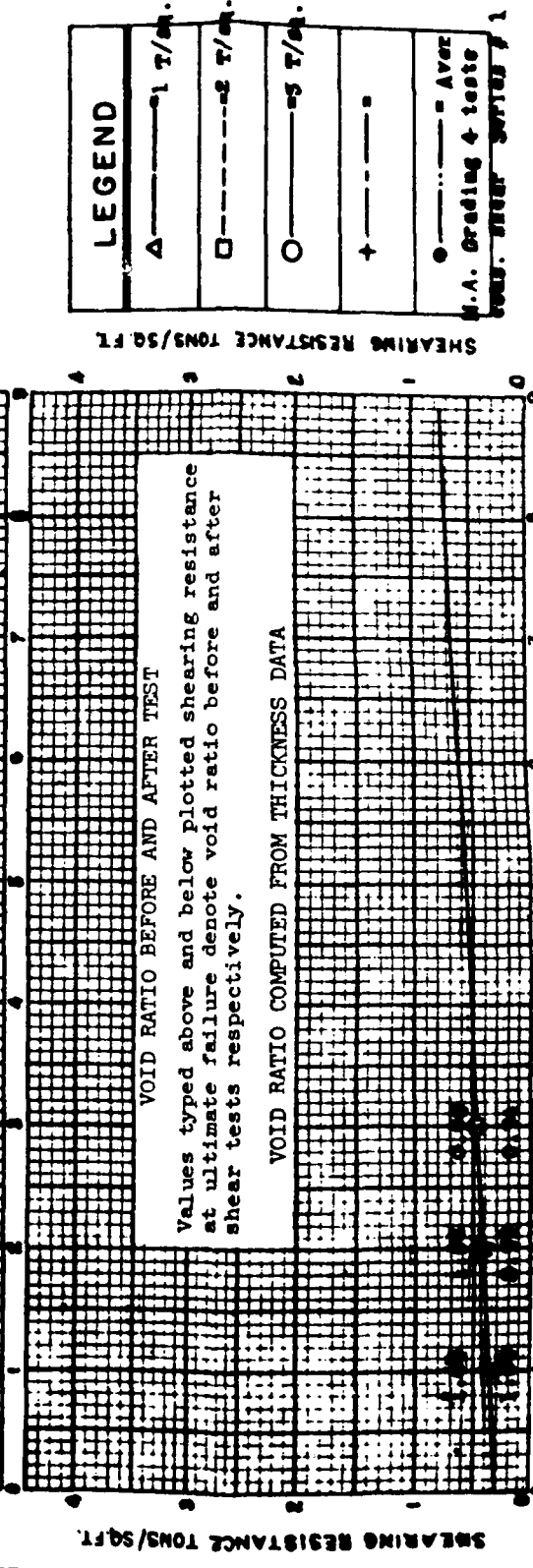
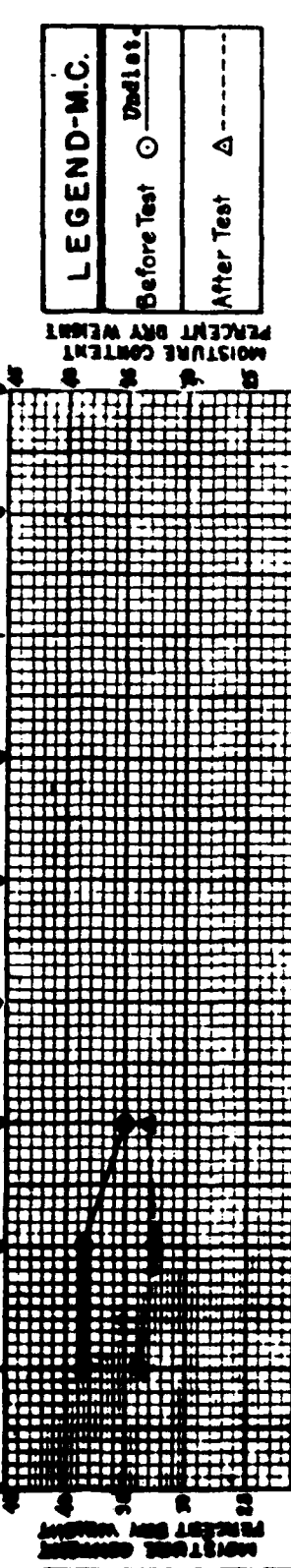
HORIZONTAL MOVEMENT IN INCHES

VERTICAL MOVEMENT IN INCHES

HORIZONTAL MOV



VERTICAL AND HORIZONTAL MOVEMENT CURVES DURING TEST



VOID RATIO BEFORE AND AFTER TEST
Values typed above and below plotted shearing resistance at ultimate failure denote void ratio before and after shear tests respectively.

VOID RATIO COMPUTED FROM THICKNESS DATA

LEGEND-M.C.	
Before Test	○ Undist.
After Test	△

LEGEND	
△	1 T/50 ft.
□	2 T/50 ft.
○	3 T/50 ft.
+	4 T/50 ft.
●	5 T/50 ft.
○	Ave
○	A.A. Grading & tests
○	Cons. shear series # 1

NORMAL LOAD-SHEARING RESISTANCE CURVE

Notes: Undisturbed Sample

Quick Shear Tests
Constant Strain Loading
Elevation 2053.1-2052.5
Depth- 45.2-45.6

Tross Sectional Area of Sample 16.00 sq. in.
Initial Thickness = 0.5 inol
Sample Interced in After Parting Isst
Station 27416 Range 2242

Shearing Resistance
Cohesion (from test)
C = 0.081

φ = 29°5'

c = Cohesion = 0.30 T/50 ft.

MISSOURI RIVER IMPROVEMENT
NAVIGATION, FLOOD CONTROL, POWER, IRRIGATION

FORT PECK DAM

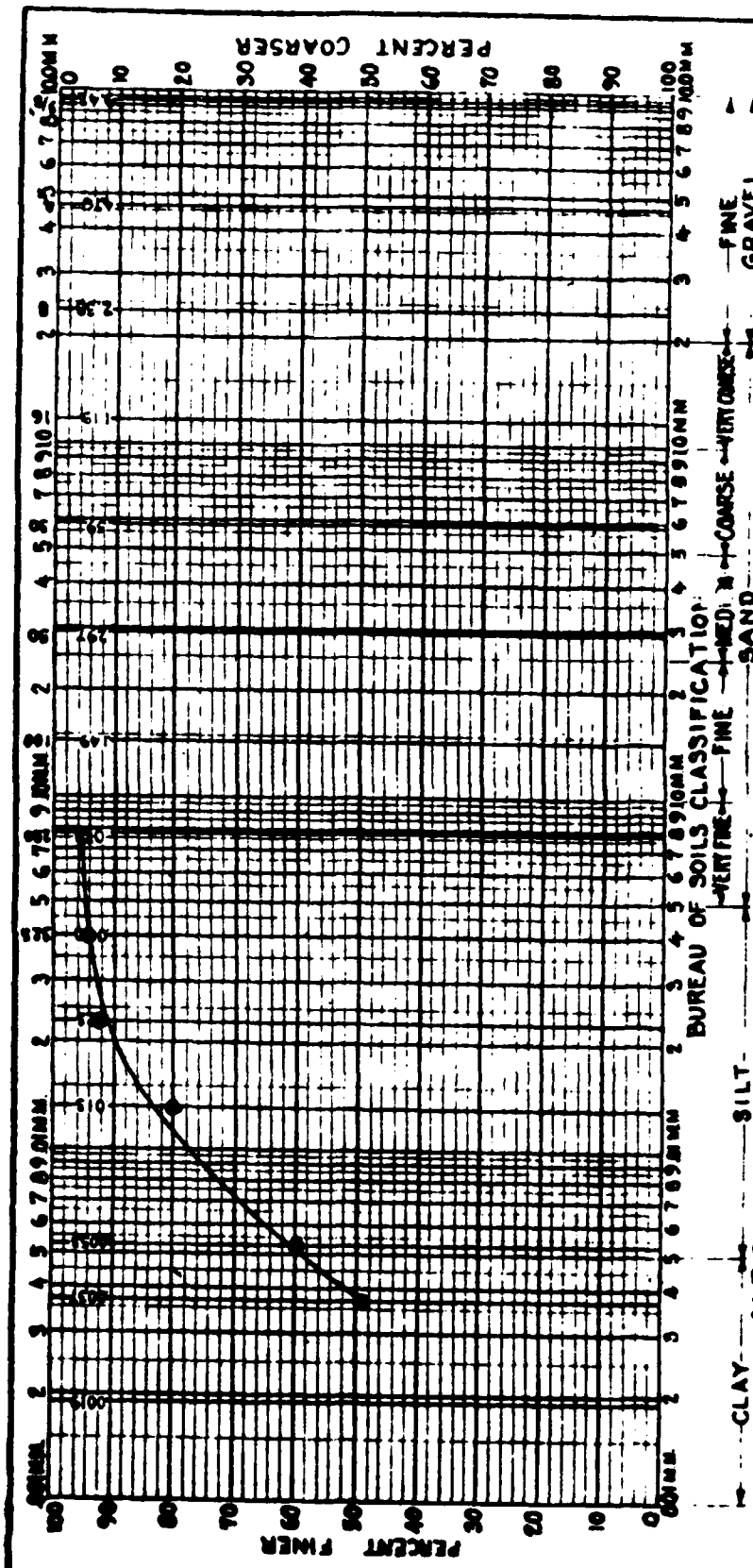
SLIDE INVESTIGATION
Quick Shear Tests-Series # 3
SUTPAC CLAY-HOLTC-11 Sample # 2

U.S. ARMY CORPS OF ENGINEERS, FORT PECK, MONT. 2-4-39

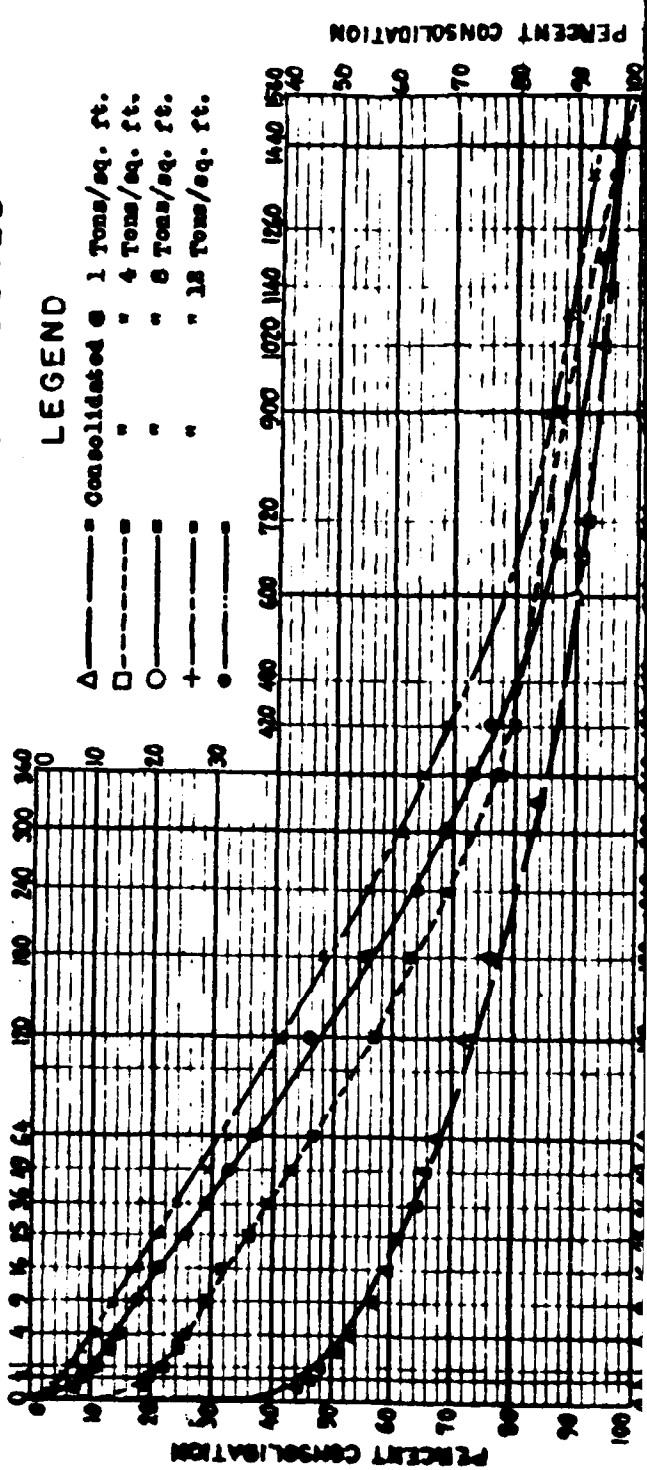
Approved Recommended Approved

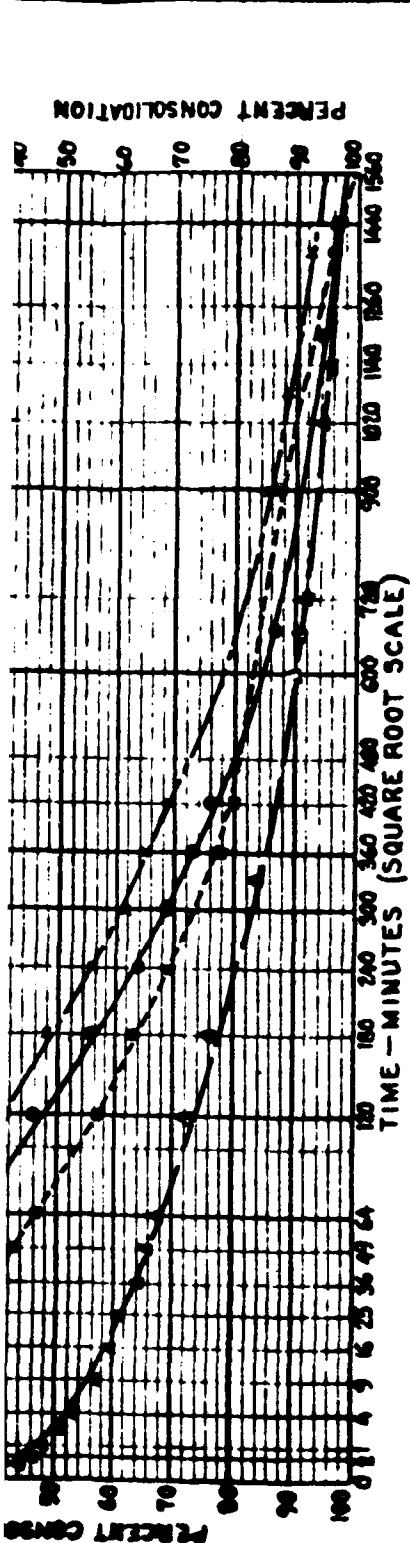
Checked by JLB
Submitted with report JLB

2

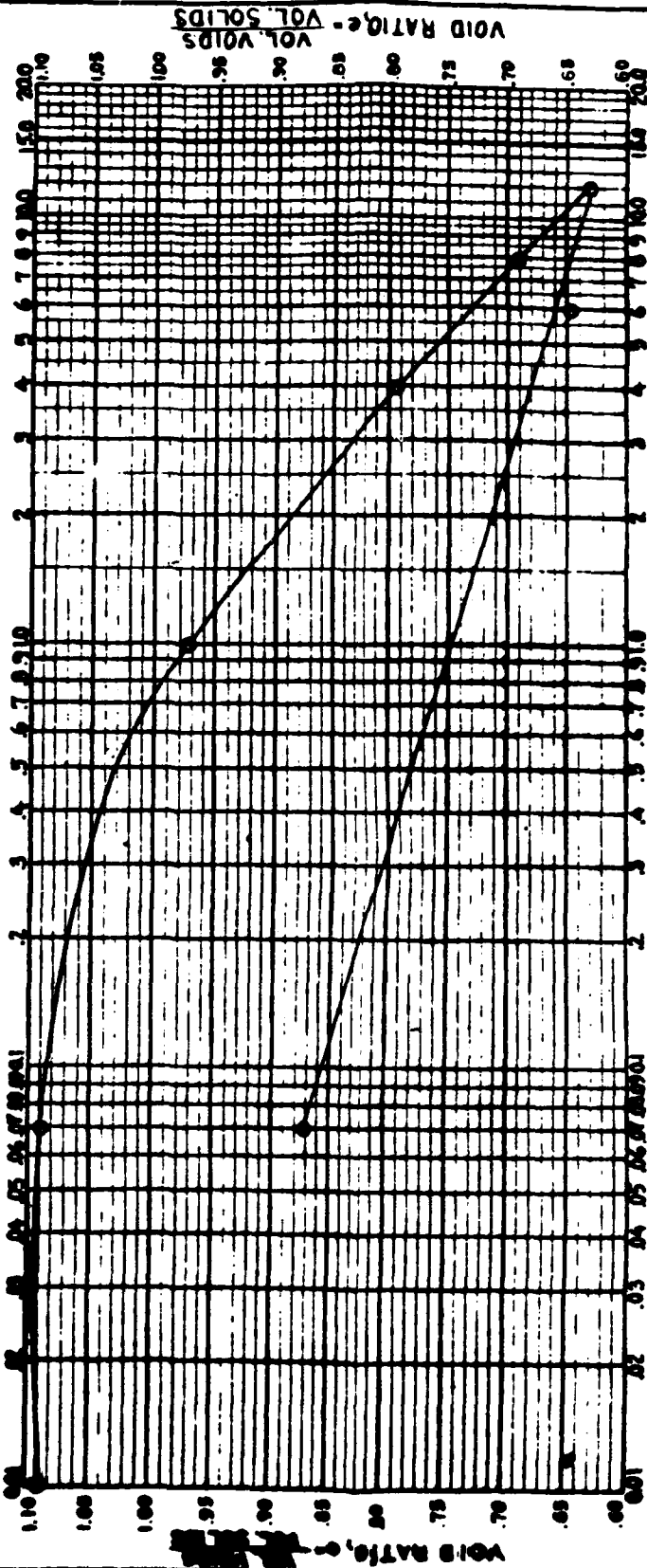


MECHANICAL ANALYSIS CURVE OF SOIL TESTED





TIME-PERCENT CONSOLIDATION CURVES



VERTICAL LAMB	COMPACTION
TIME (MIN)	PERCENT
0.00	0.00
0.07	0.00
1.00	5.55
4.00	14.10
8.00	18.11
12.00	21.73
4.00	21.02
0.07	10.17

PRESSURE-VOID RATIO CURVE

Estimated Previous Consolidation Tons/Sq.Ft.

Undisturbed Sample Immersed in Water during test
 Station 27 + 16, Range 22 + 22-U
 Initial Thickness 1.00 inch
 Gross Sectional Area 24.80 sq. in.
 Elevation - 2051.8 - Depth 46.5'

* Total compaction in percent of original height of sample.

MISSOURI RIVER IMPROVEMENT
 NAVIGATION, FLOOD CONTROL, POWER, IRRIGATION

FORT PECK DAM

SLIDE INVESTIGATION
 CONSOLIDATION TEST SURFACE CLAY
 HOLE C-11, SAMPLE NO. 3

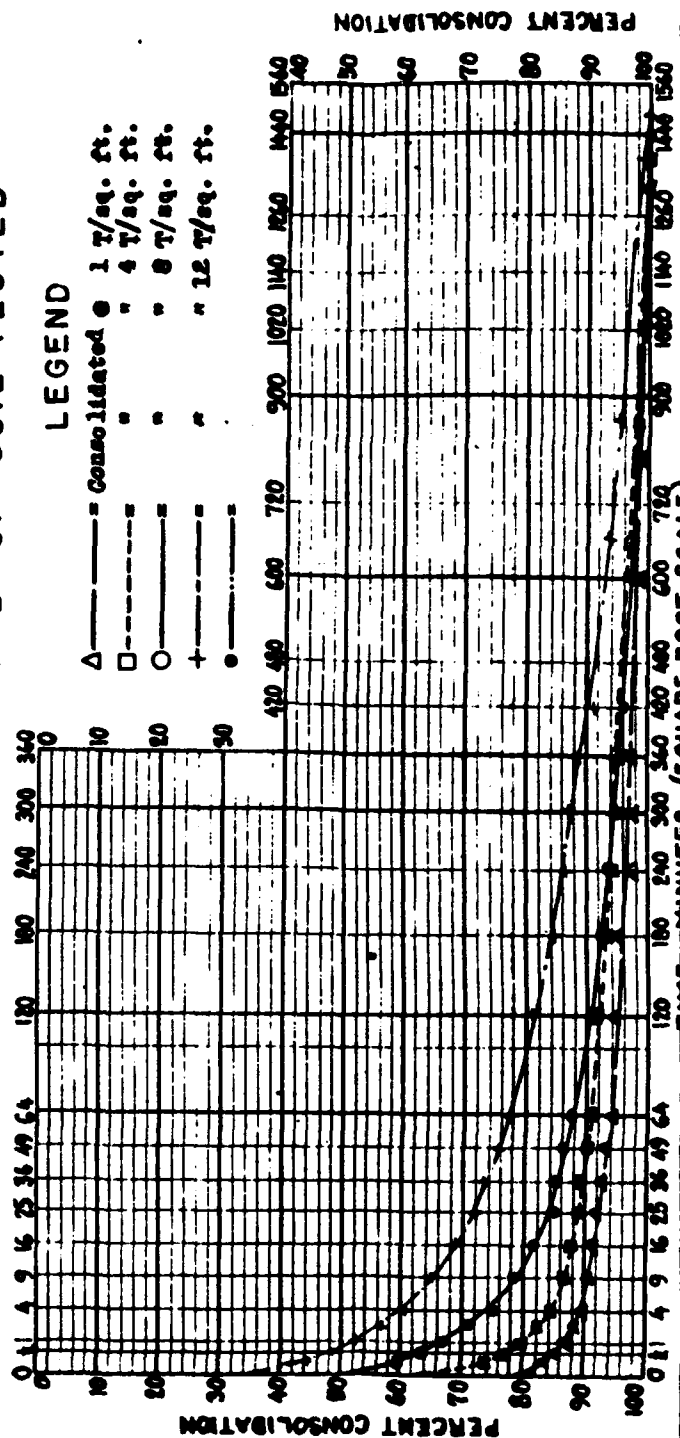
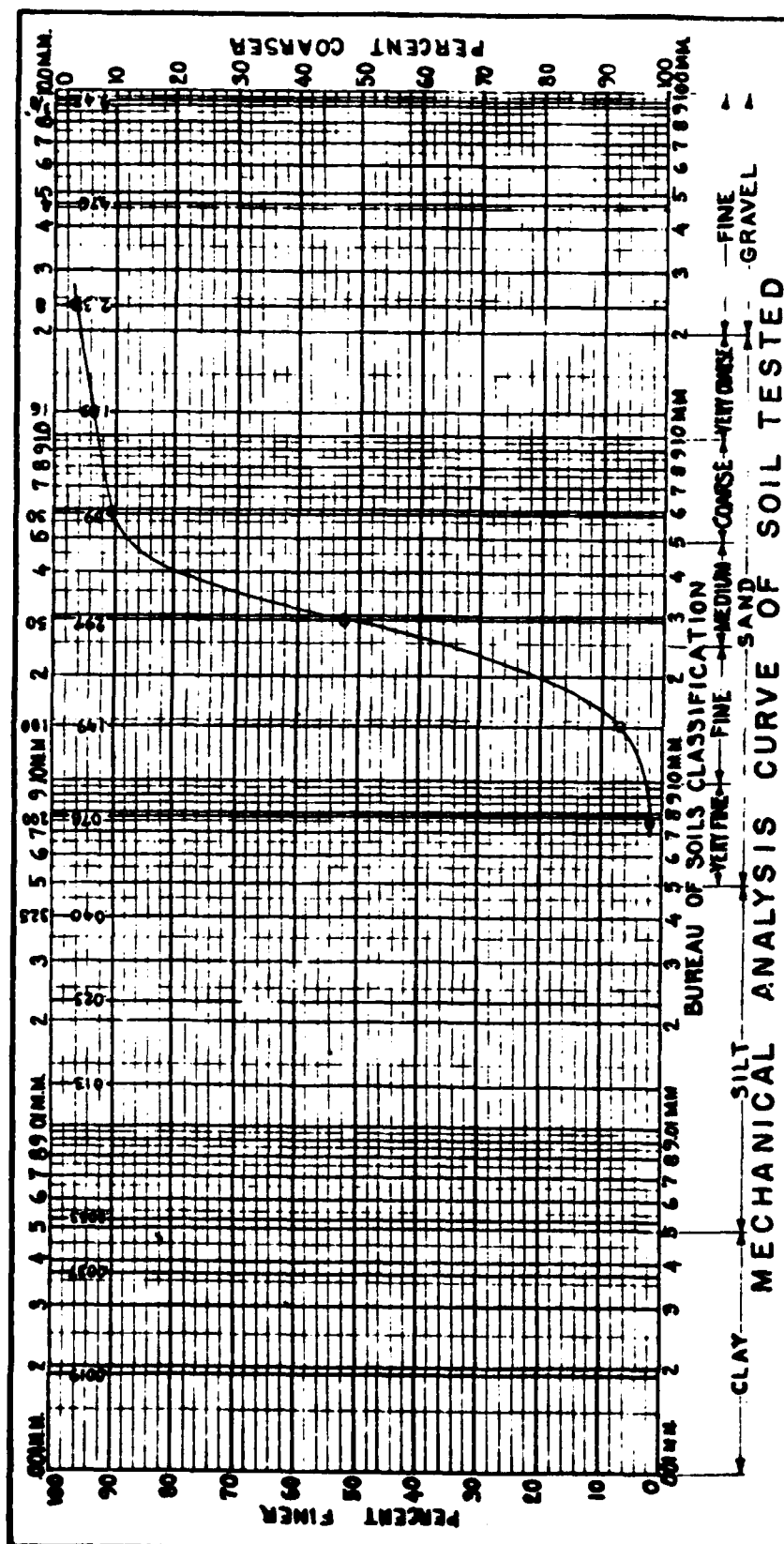
U.S. ENGINEER OFFICE, FORT PECK, MONT 1-13-39

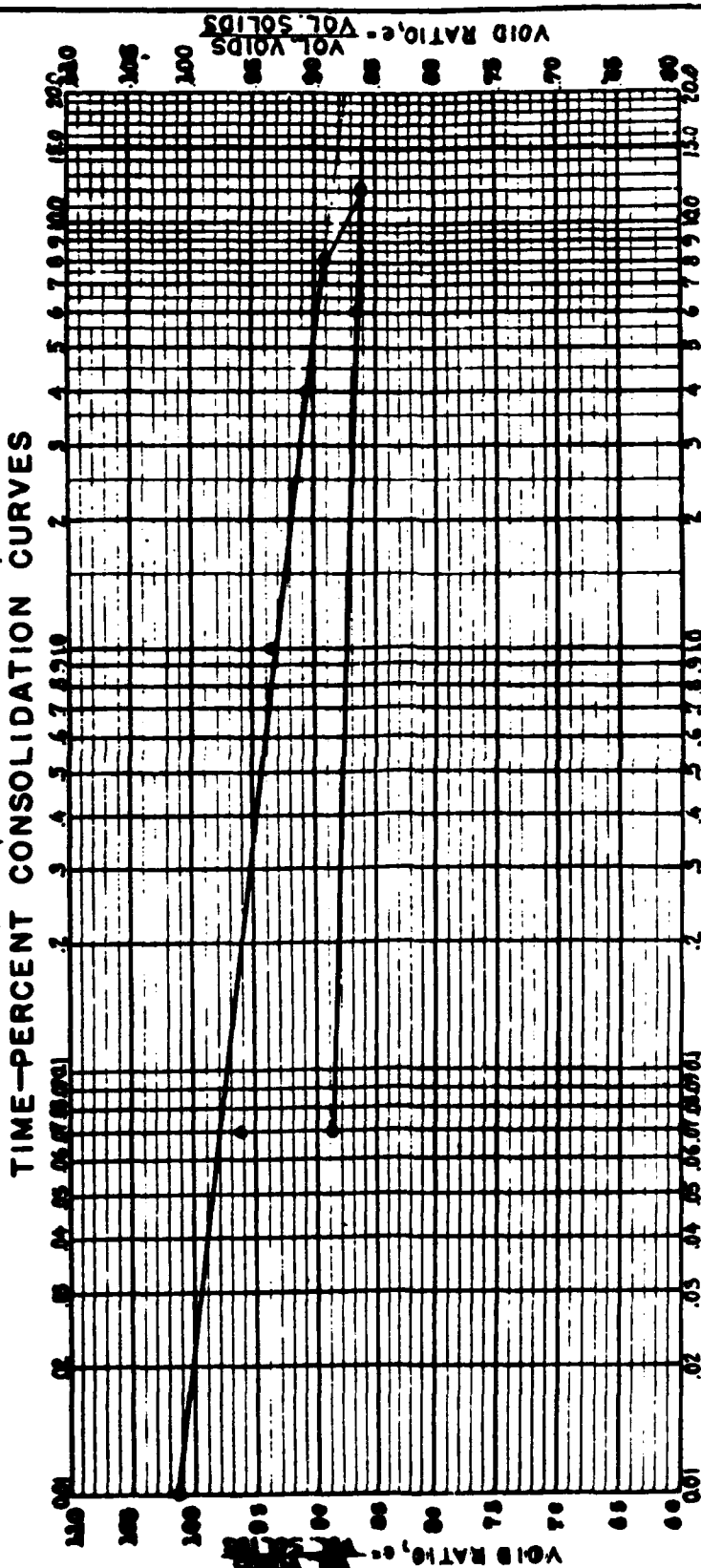
Submitted by: ☐ Approved: ☐

Checked by: ☐ Approved: ☐

Drawn by: ☐ Approved: ☐

DES EBC WA



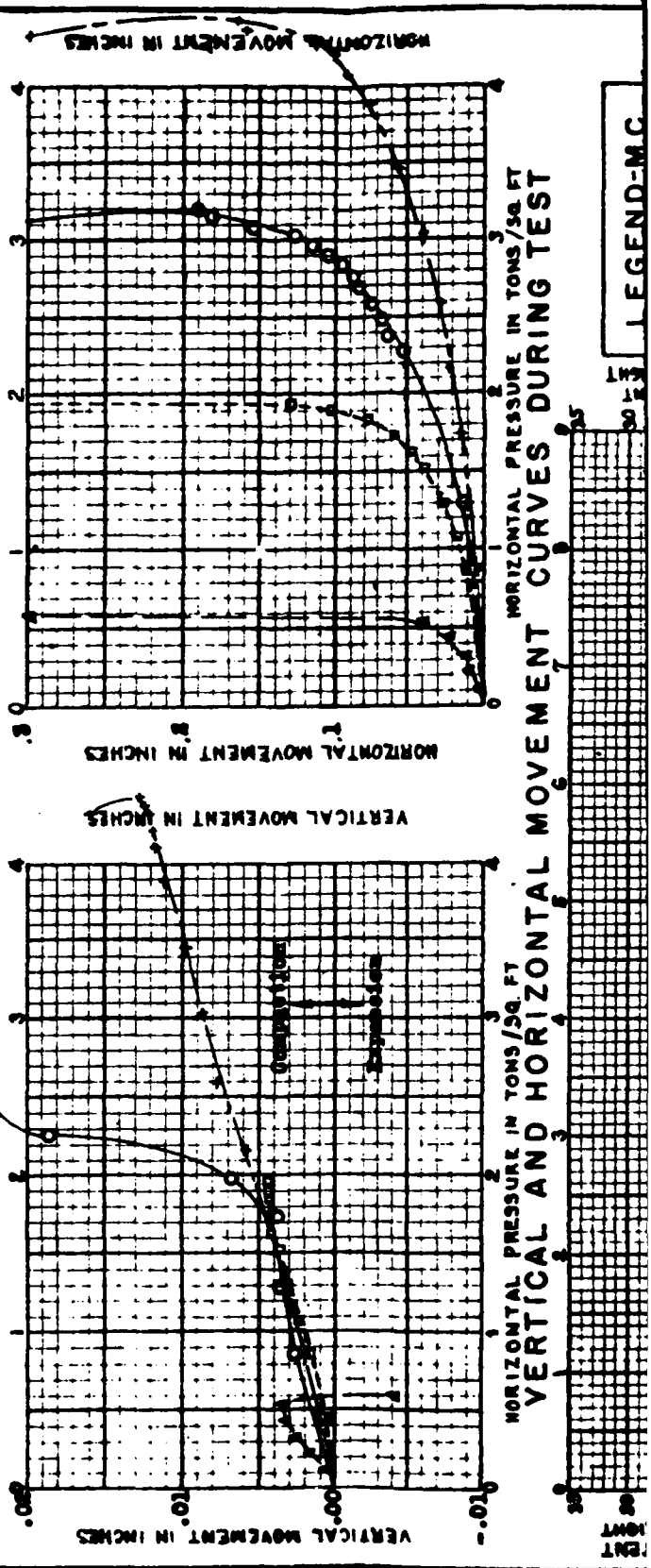
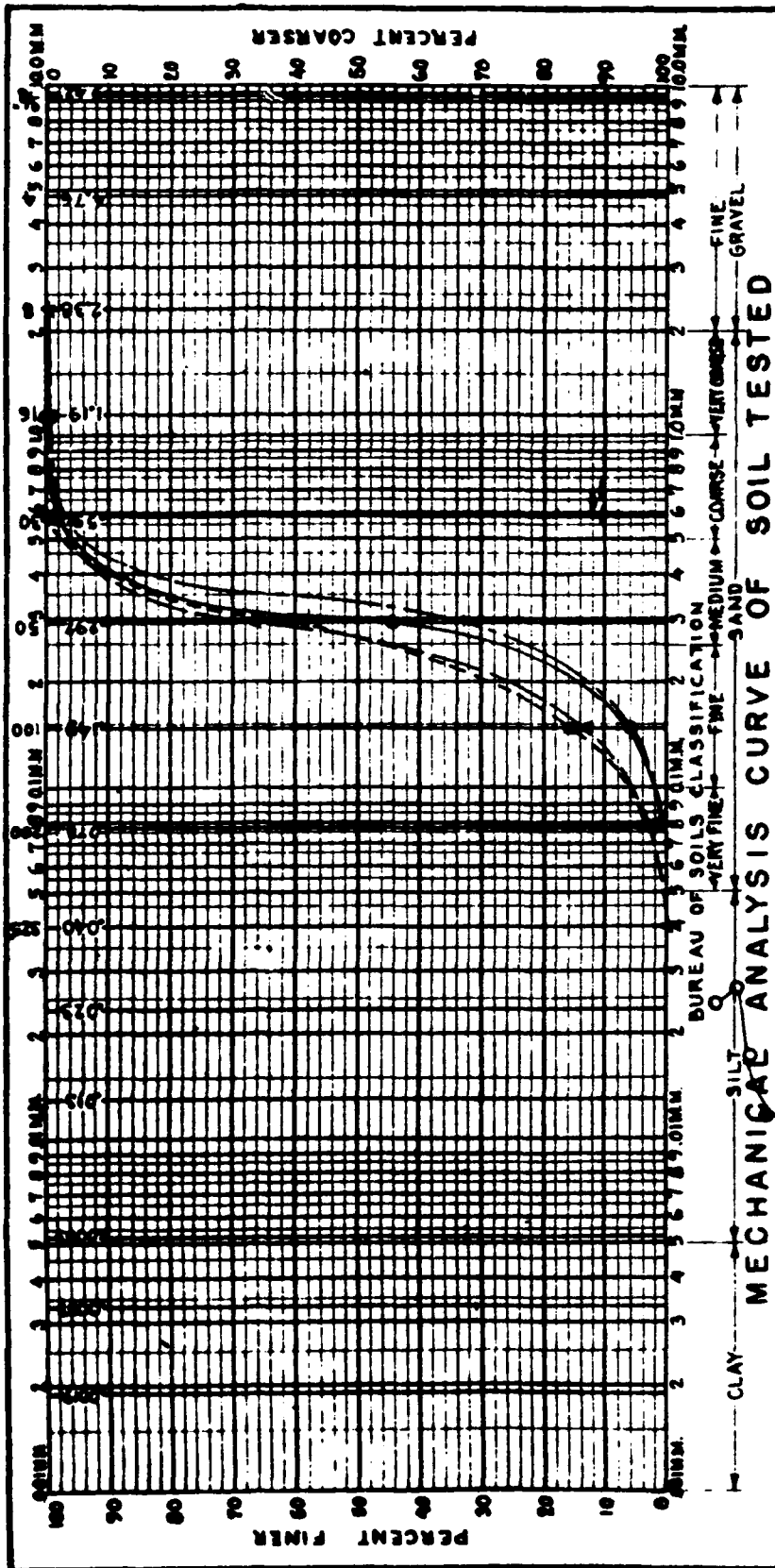


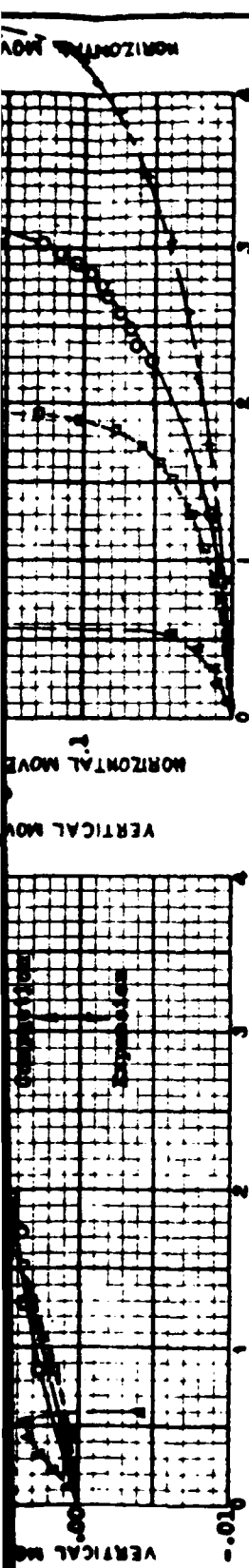
VERTICAL LOAD TONS/SQ. FT.	COMPACTION PERCENT
0.00	0.00
0.07	1.76
1.00	3.07
4.00	4.08
8.00	5.48
12.00	6.80
20.00	6.87
0.07	5.45

Undisturbed Sample Immersed in Water during test
Station 41 / 00; Range 0 / 26-U
Initial Thickness 2.50 inch
Gross Sectional Area 24.80 sq. in.
Elevation 47.2; Depth 8'

* Total compaction in percent of original height of sample.

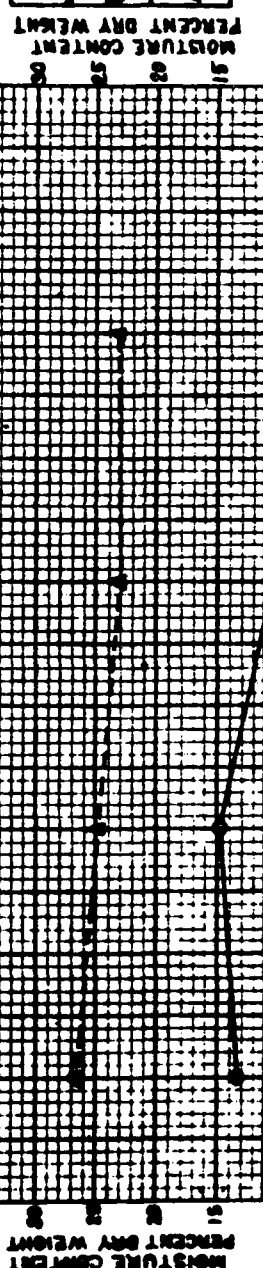
MISSOURI RIVER IMPROVEMENT
NAVIGATION, FLOOD CONTROL, POWER, IRRIGATION
FORT PECK DAM
SLIDE INVESTIGATION
CONSOLIDATION TEST, TRANSITION MATERIAL
TEST PIT NO. 5; SERIES #1
U.S. ENGINEER OFFICE, FORT PECK, MONT.
Submitted: _____ Approved: _____
Checked by: _____
Drawn by: _____
DES. REC.



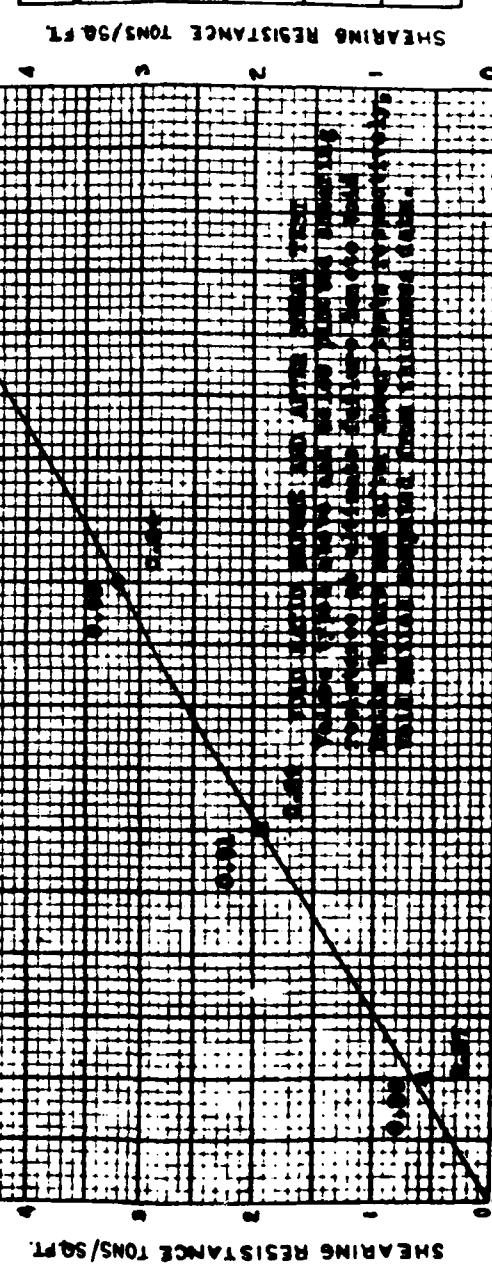


HORIZONTAL PRESSURE IN TONS/SQ. FT.
VERTICAL AND HORIZONTAL MOVEMENT CURVES DURING TEST

LEGEND-M.C.	
Before Test	○
After Test	△



LEGEND	
△	1 T/40. 50
□	3 T/40. 50
○	5 T/40. 50
+	7 T/40. 50
●	9 T/40. 50



VERTICAL LOAD TONS/SQ. FT.
NORMAL LOAD-SHEARING RESISTANCE CURVE

Notes:
Undisturbed Sample Test No. 45
Consolidated Shear Tests
Increment Loading
Elevation 2242.7
Depth - 8'
Gross Sectional Area of Sample 16.00 sq. in.
Initial Thickness 0.75 inch.
Sample Immersed in Water During Test
Station 41 + 00, Range 0 + 25-0

Shearing Resistance
Cohesion (from test)
Avg. Vertical Load (from test)
0.040
φ = 36° 30'
c = Cohesion = 0.07/eq. ft.

MISSOURI RIVER IMPROVEMENT
NAVIGATION, FLOOD CONTROL, POWER, IRRIGATION

FORT PECK DAM
SLIDE INVESTIGATION
CONSOLIDATED SHEAR TESTS SERIES #2
TRANSITION ZONE MATERIAL

U.S. ENGINEER OFFICE, FORT PECK, MONT. 5-27-39

Approved: _____
Special Recommended Approved

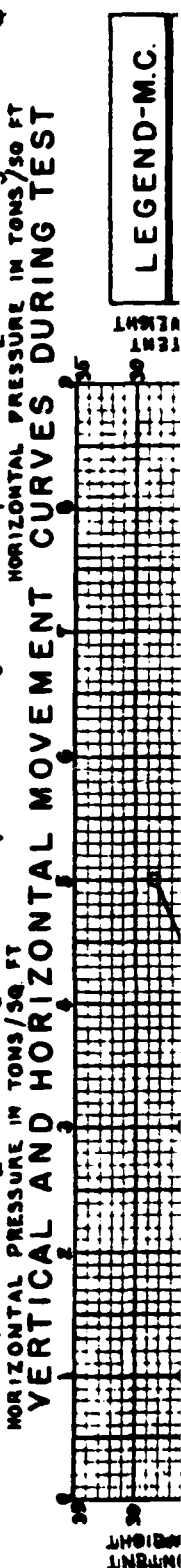
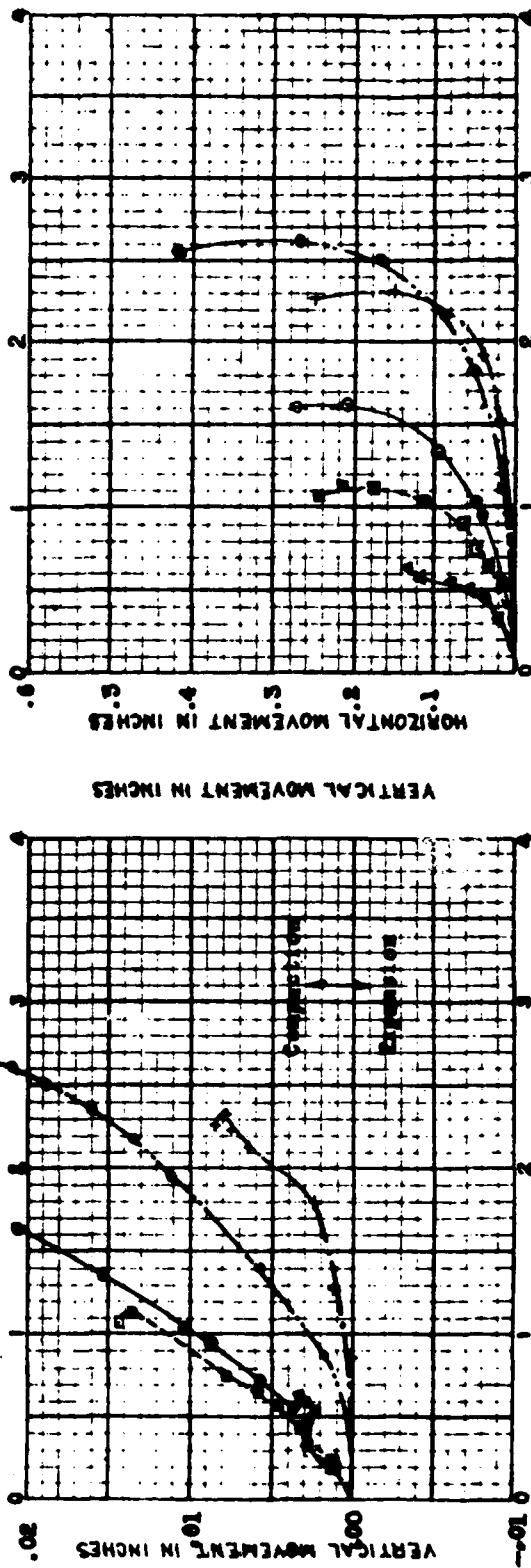
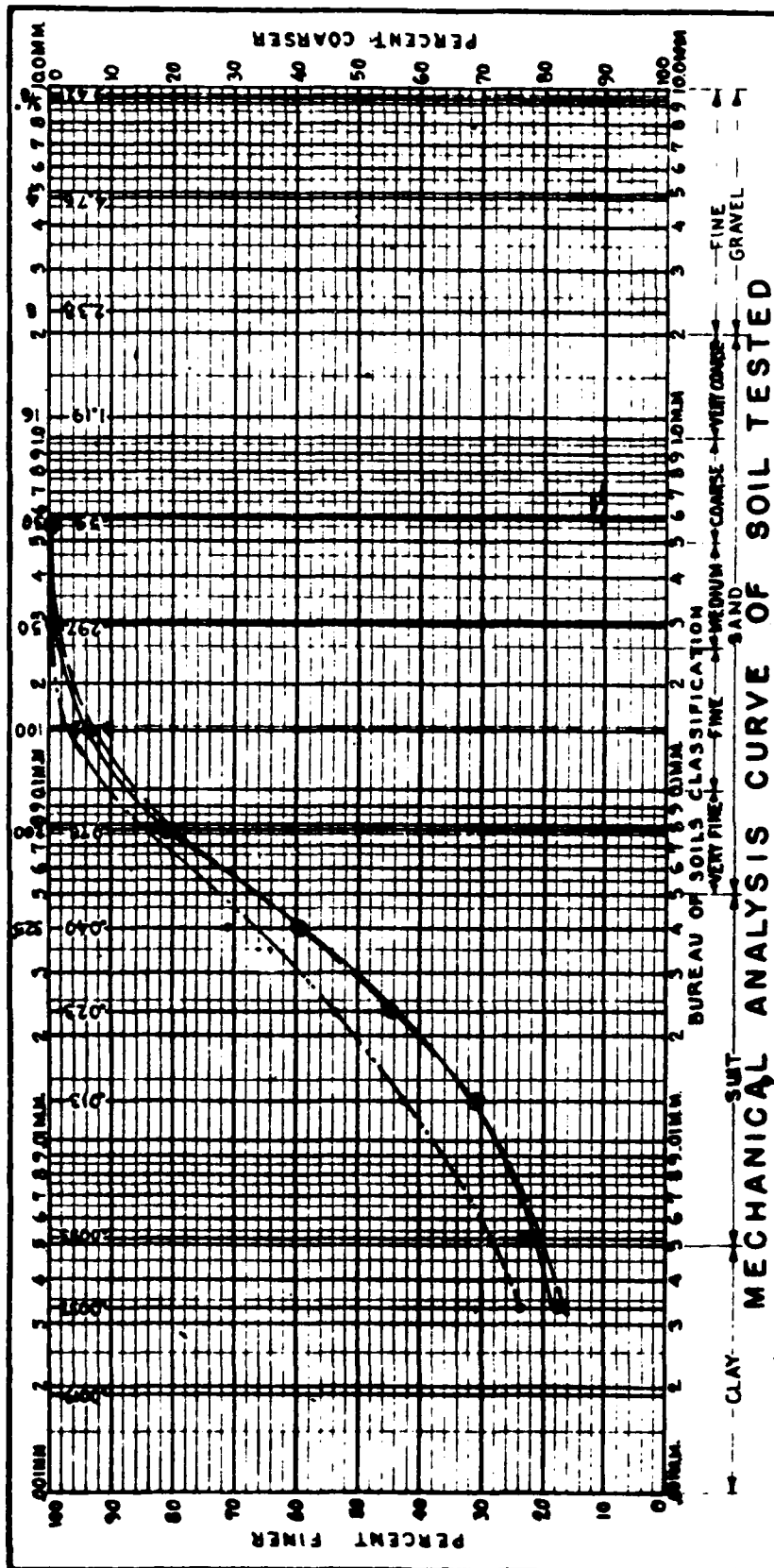
Major Corps of Engineers U.S. Army
Checked by: _____
JTB EBC DED dated

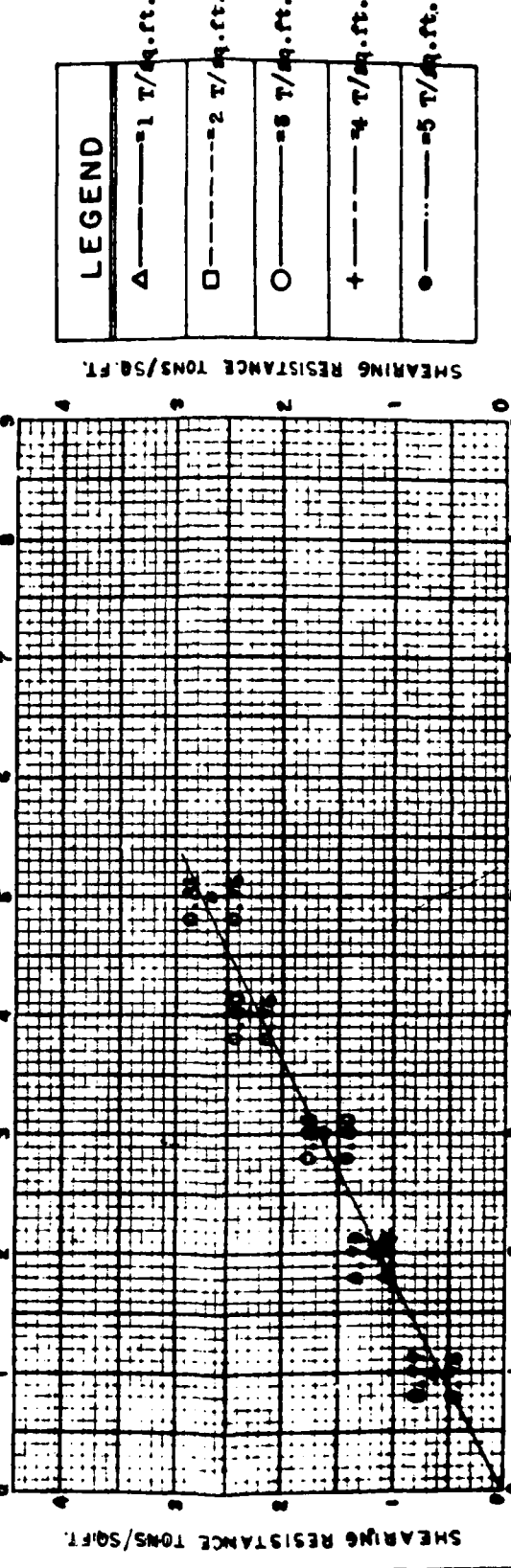
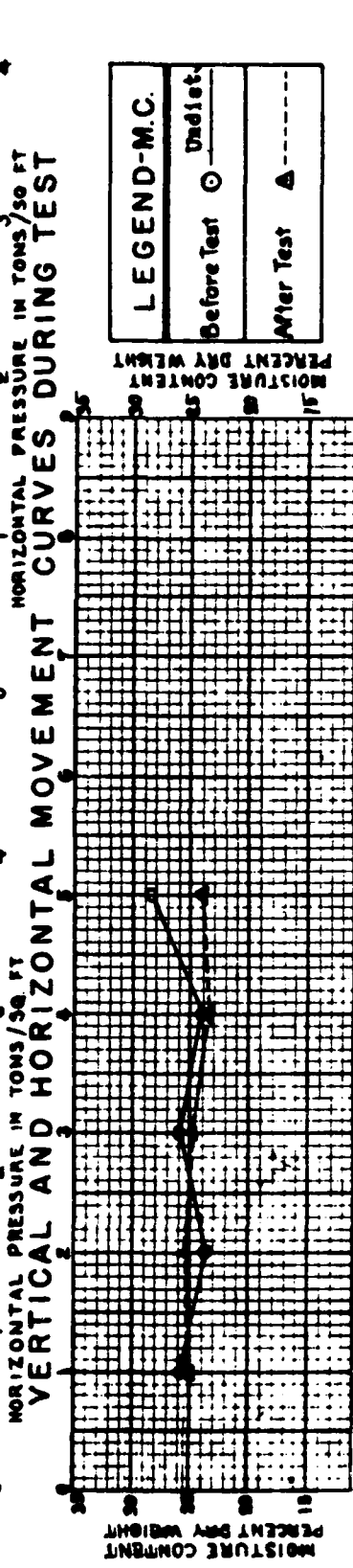
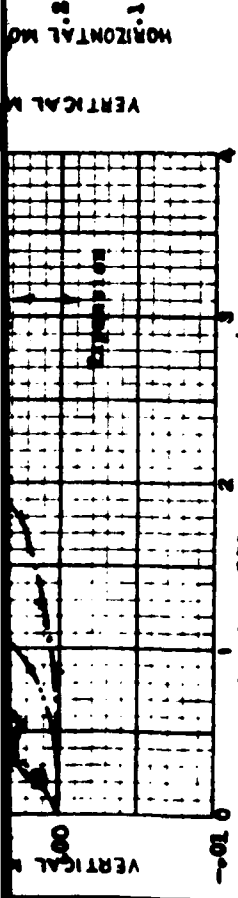
CALYX HOLE NO. 4—STATION 14+79, RANGE 0+87-U

(Original sheets 2 and 3)

Cone No.	Elevation top of cone	Specific gravity	Moisture content, percent	Void ratio "E"	Percent of voids
1	2,124.30	2.697	23.7	0.783	43.9
2	2,122.00	2.693	20.7	.627	38.5
3	2,119.70	2.701	21.5	.676	40.3
4	2,118.30	2.689	21.5	.635	38.8
5	2,116.50	2.693	19.3	.564	36.1
6	2,114.30	2.704	20.2	.603	37.6
7	2,112.90	2.684	21.1	.624	38.4
8	2,110.72	2.691	20.6	.601	37.5
9	2,108.90	2.690	17.6	.512	33.8
10	2,107.20	2.692	18.7	.542	35.1
11	2,105.50	2.712	17.1	.509	33.7
12	2,103.88	2.682	20.7	.604	37.7
13	2,101.39	2.677	23.9	.731	42.2
14	2,099.29	2.690	22.2	.696	41.0
15	2,097.36	2.675	21.5	.665	40.0
16 ¹	2,095.20				
17	2,092.70	2.676	22.6	.670	40.1
18	2,090.60	2.678	21.6	.645	39.2
19	2,088.57	2.664	22.0	.637	38.9
20	2,086.71	2.688	22.1	.654	39.5
21	2,085.20	2.690	20.7	.619	38.2
22	2,082.70	2.665	21.2	.607	37.8
23	2,080.74	2.675	23.8	.723	42.0
24	2,078.81	2.714	19.3	.708	41.5
25	2,077.25	2.694	21.0	.644	39.2
26	2,074.94	2.669	21.6	.650	39.4
27A	2,072.90	2.685	21.6	.674	40.3
B		2.691	21.7	.685	40.6
28	2,071.43	2.680	22.4	.673	40.2
29	2,069.20	2.703	19.2	.570	36.3
30	2,067.50	2.690	21.4	.639	39.0
31	2,064.90	2.692	21.4	.643	39.1
32	2,062.70	2.691	21.8	.648	39.3
33	2,061.00	2.697	21.7	.635	38.9
34	2,058.60	2.677	22.7	.666	39.9
35	2,056.10	2.692	21.4	.619	38.2
36	2,054.46	2.689	19.6	.568	36.2
37	2,052.20	2.688	19.1	.566	36.1
38	2,050.00	2.680	19.3	.551	35.5
39	2,048.90	2.743	26.6	.824	45.2
40	2,046.30	2.732	29.5	.680	40.5
41	2,043.60	2.697	28.3	.867	46.4
42	2,041.10	2.701	24.1	.750	42.8
43	2,039.70	2.727	22.7	.711	41.6

¹ First half destroyed, no sample obtained from other half of core.





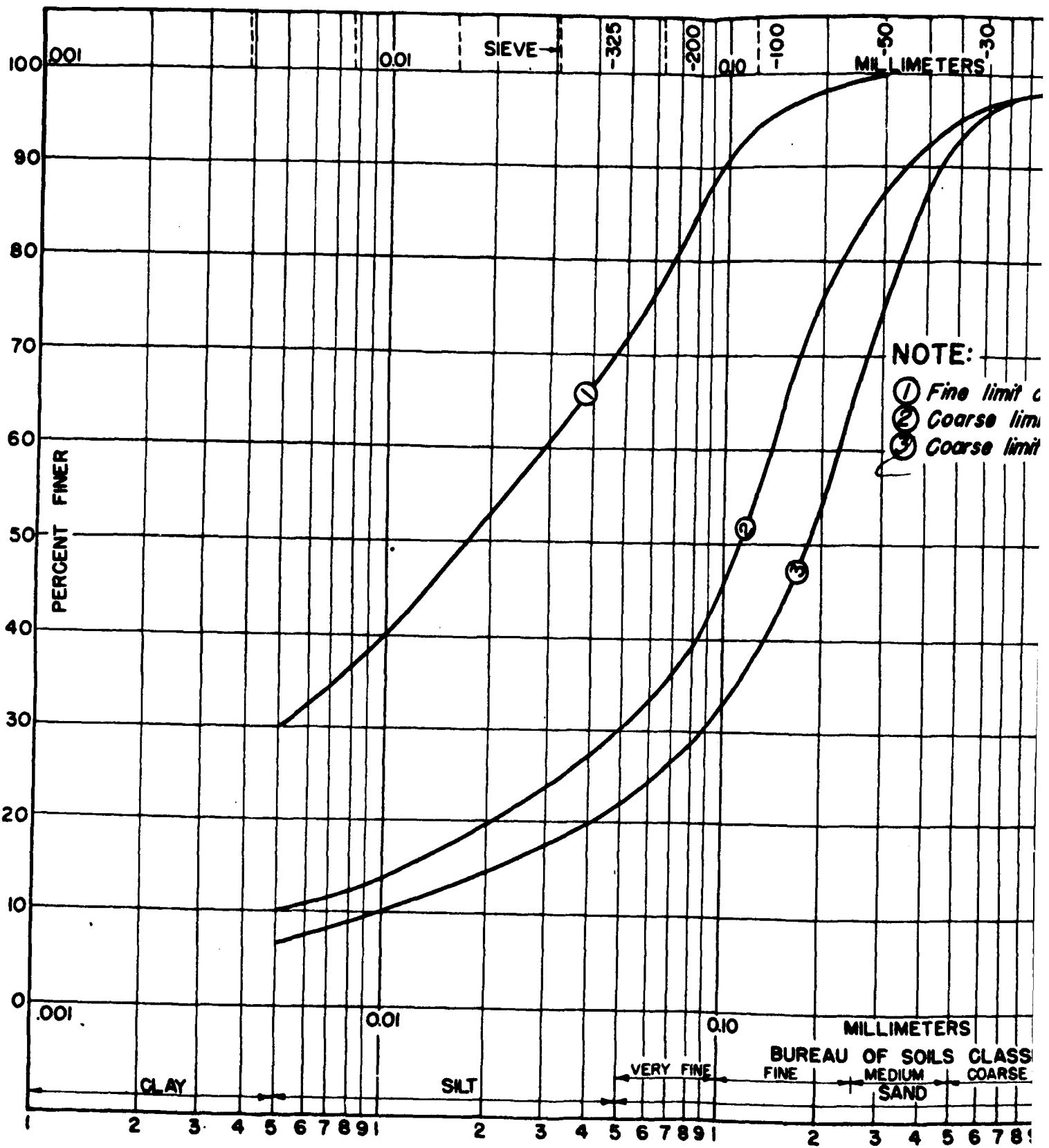
LEGEND-M.C.	Undist.	
Before Test	○	
After Test	△	

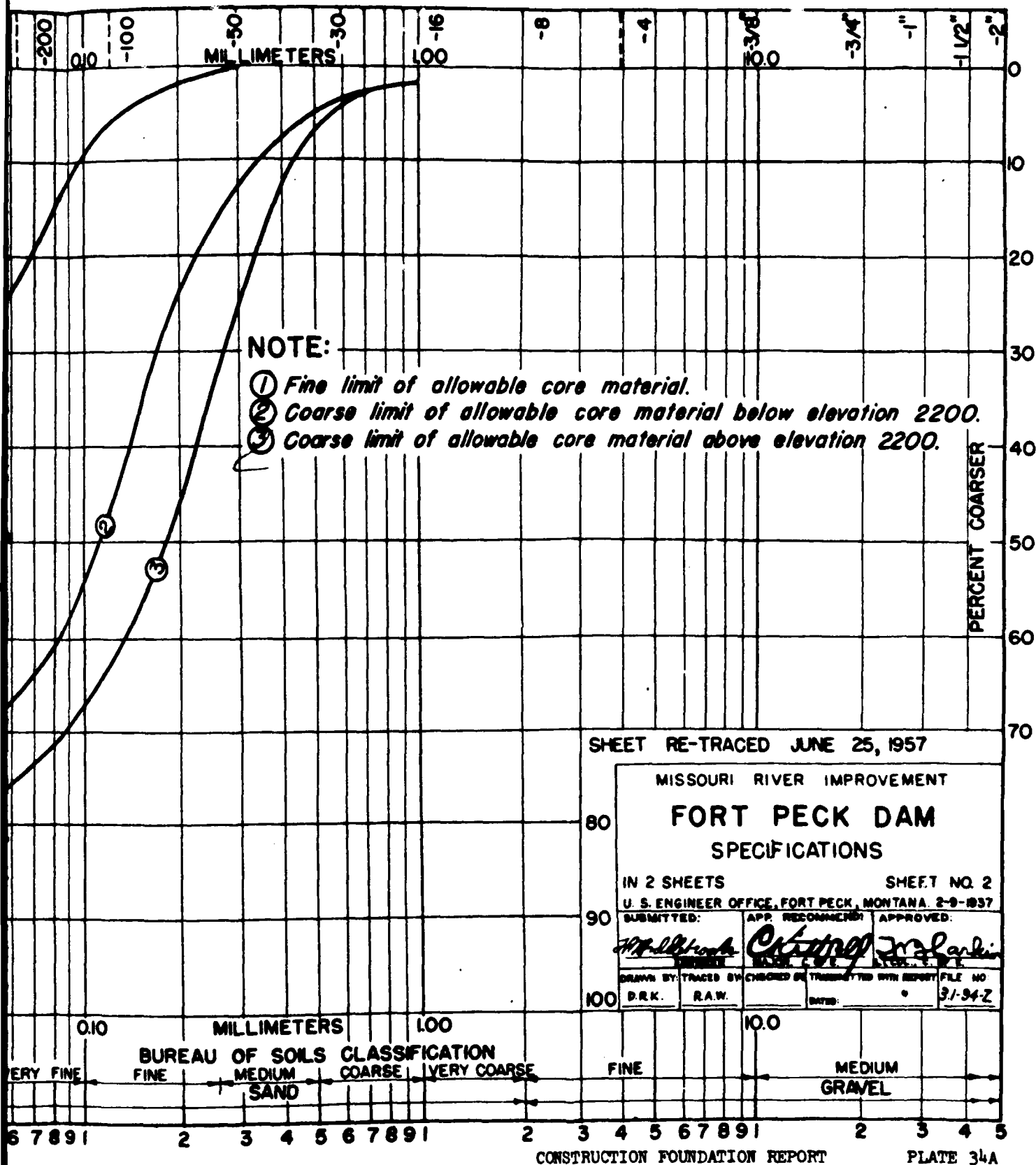
LEGEND	
Δ -----	1 T/mq.ft.
\square -----	2 T/mq.ft.
\bigcirc -----	3 T/mq.ft.
+-----	4 T/mq.ft.
\bullet -----	5 T/mq.ft.

MISSOURI RIVER IMPROVEMENT		NAVIGATION, FLOOD CONTROL, POWER, IRRIGATION	
FORT PECK DAM		SLIDE INVESTIGATION	
CONSOLIDATED SHEAR TESTS SERIES # 1 st			
MIXED MATERIAL FROM CALYX HOLE # 4			
USING LITHO SECTION MOUNT 2-7-39		Approved _____	
Submitted by _____		Checked by _____	
Drawn by J. L. B. R. J. C.	Issued by J. L. B. R. J. C.	Transmitted with report	File No.

NORMAL LOAD-SHEARING RESISTANCE CURVE
VERTICAL LOAD TONS/30. FT.
Notes: Undisturbed Sample
Consolidated Shear Tests
Increment Loading
Elevation 2047.0-2046.6
Cross Sectional Area of Sample 16.00 sq. in.
Initial Thickness = 1.00 inch
Sample Immersed in Water During Test.
Station 14+79.0 Range 0/470
Section # 39

Shearing Resistance Cohesion (tons/30 ft) Vertical Load (tons/30 ft) -0.552
$\phi = 28^{\circ}34'$
$c = \text{Cohesion} = 0.07/\text{sq. ft.}$

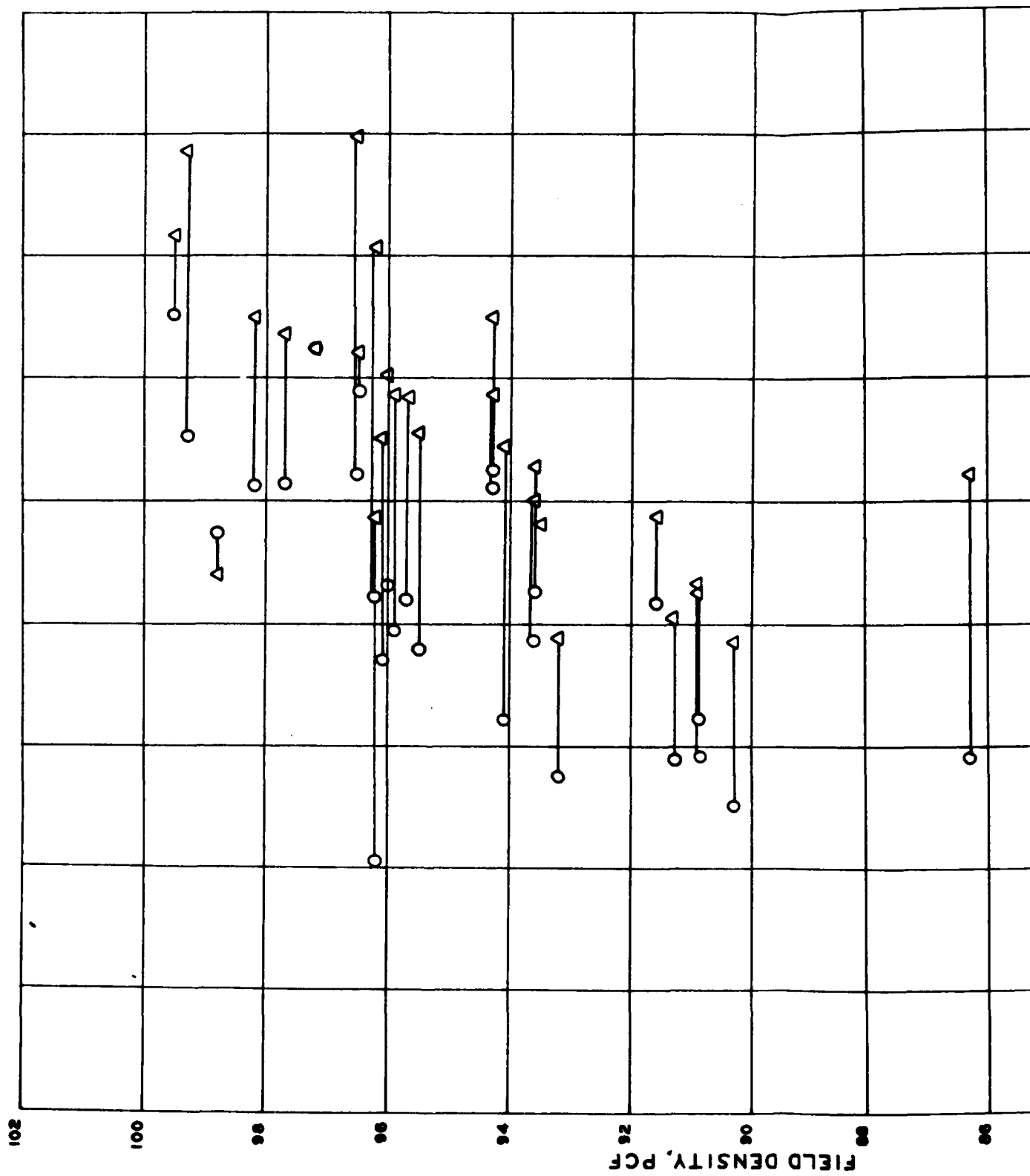


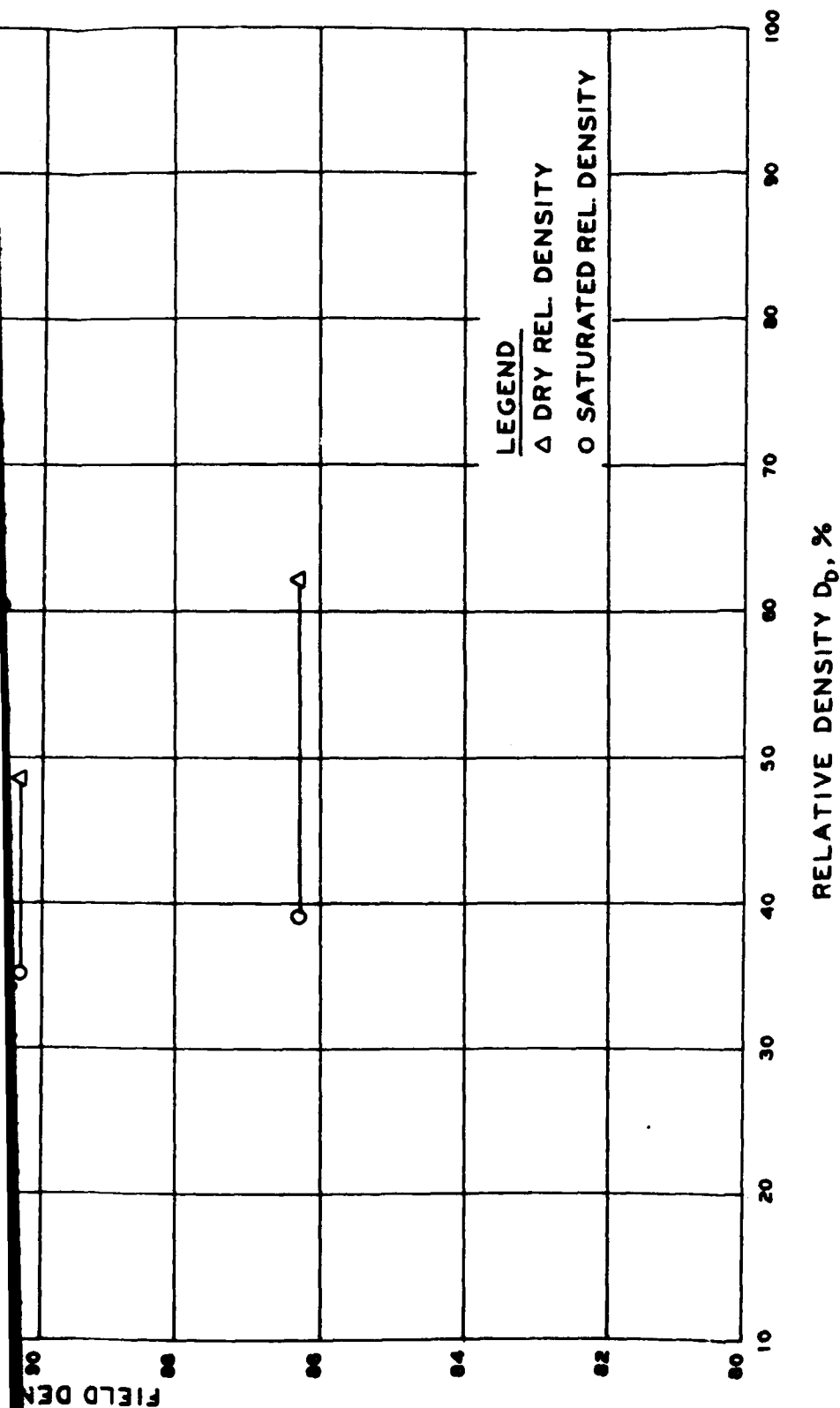


CONSTRUCTION FOUNDATION REPORT

PLATE 34A

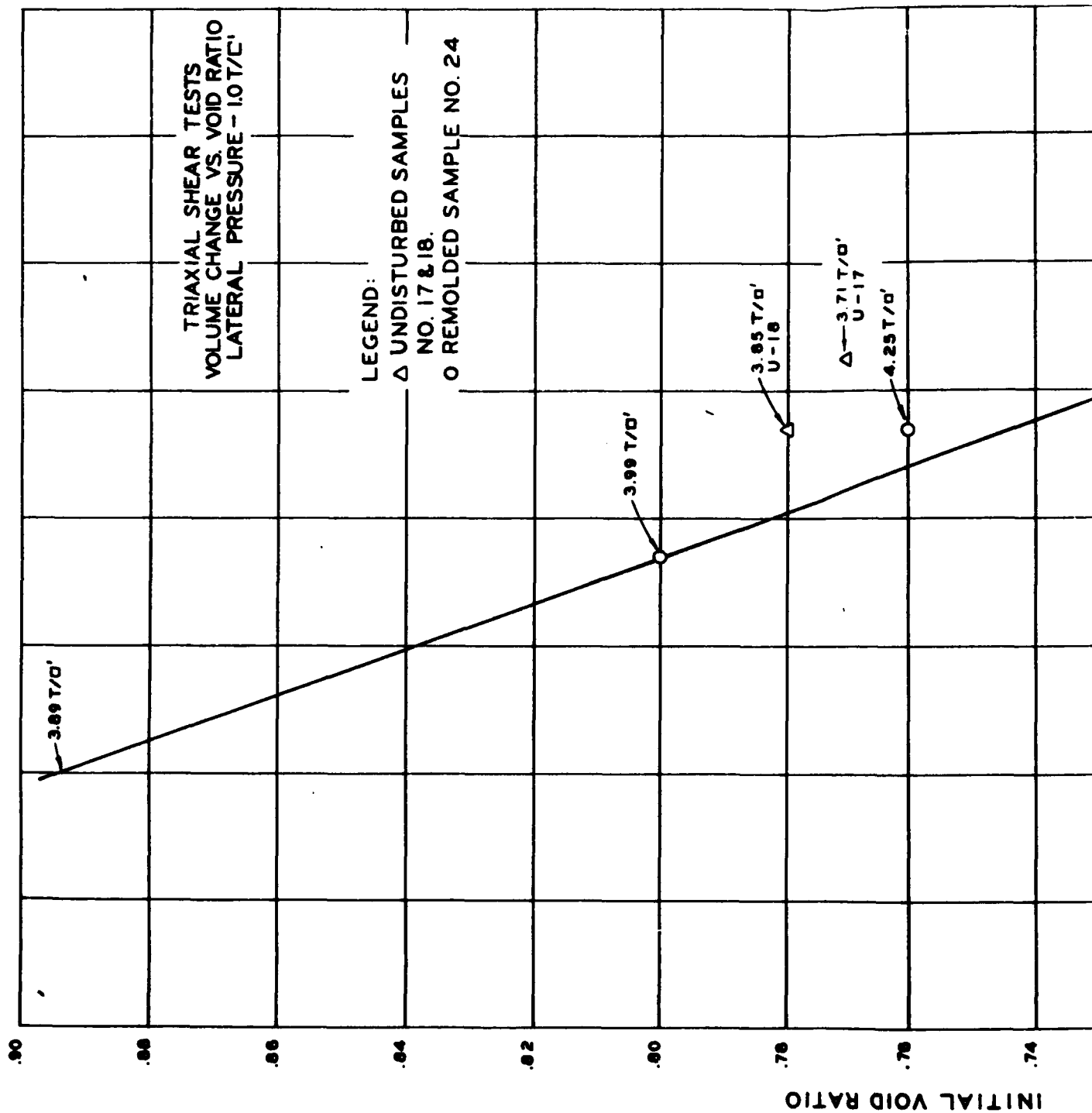
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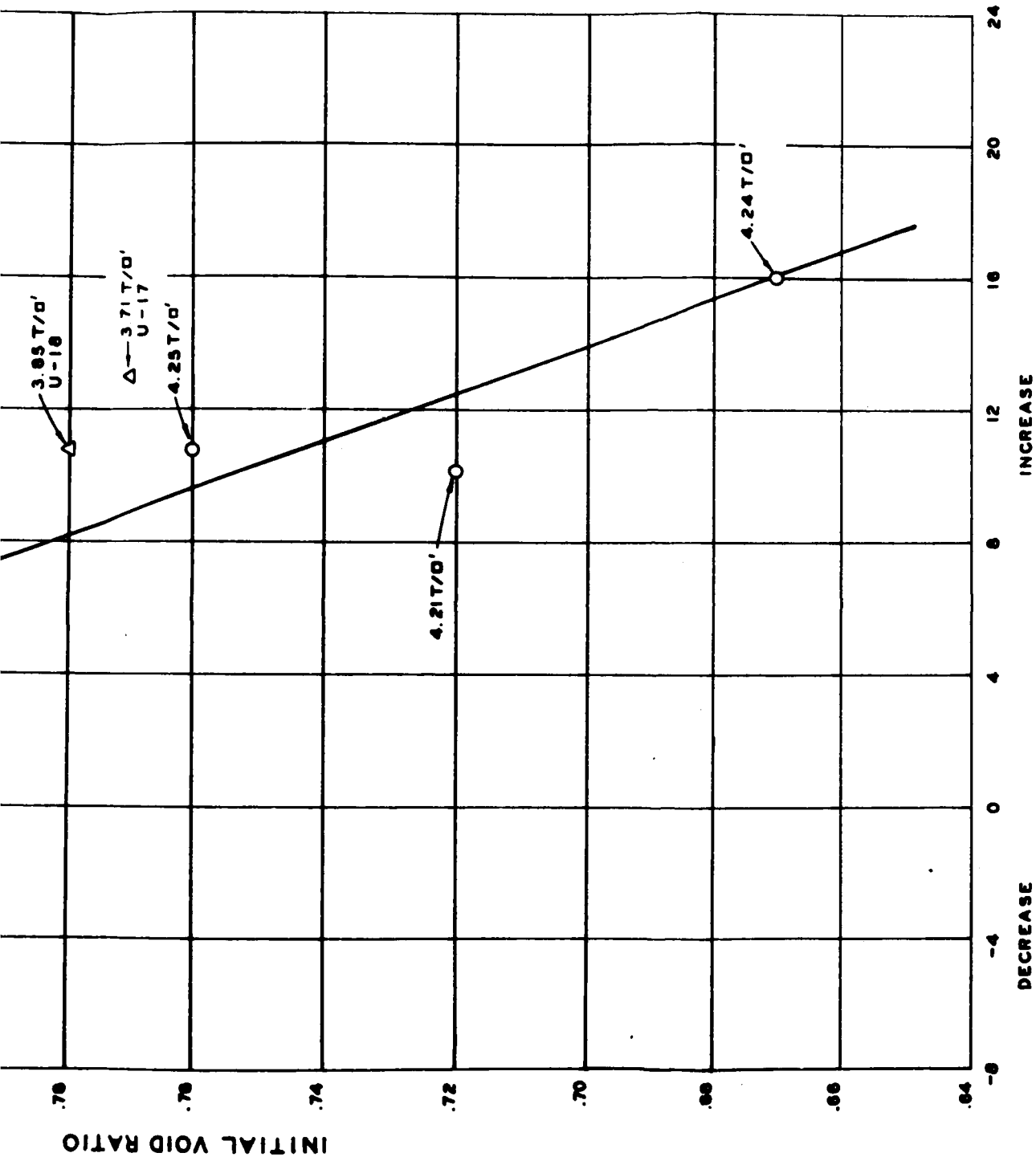




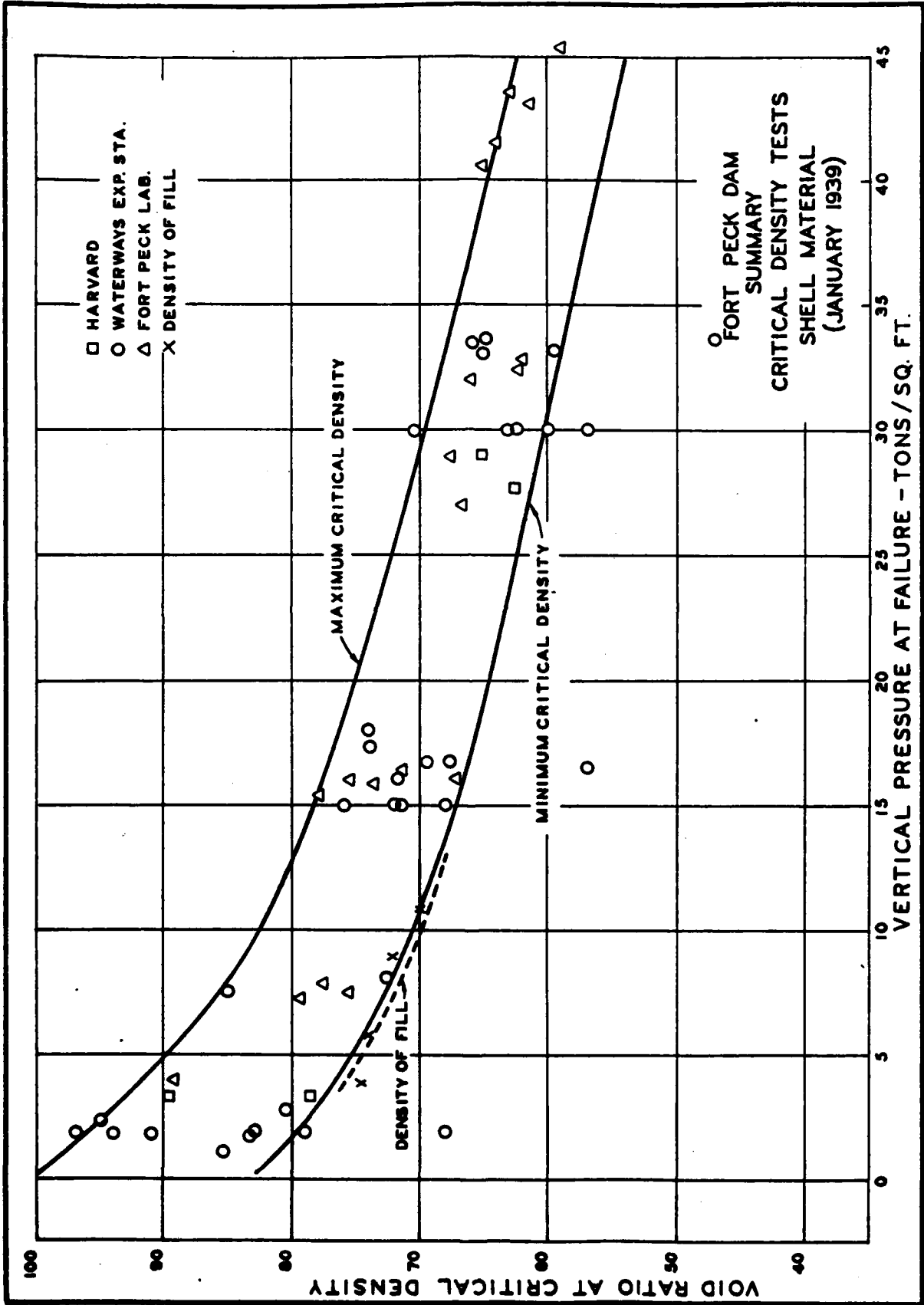
ITEM	RANGE OF VALUES
SPECIFIC GRAVITY	2.68 - 2.73
EFFECTIVE SIZE	0.11 - 0.21

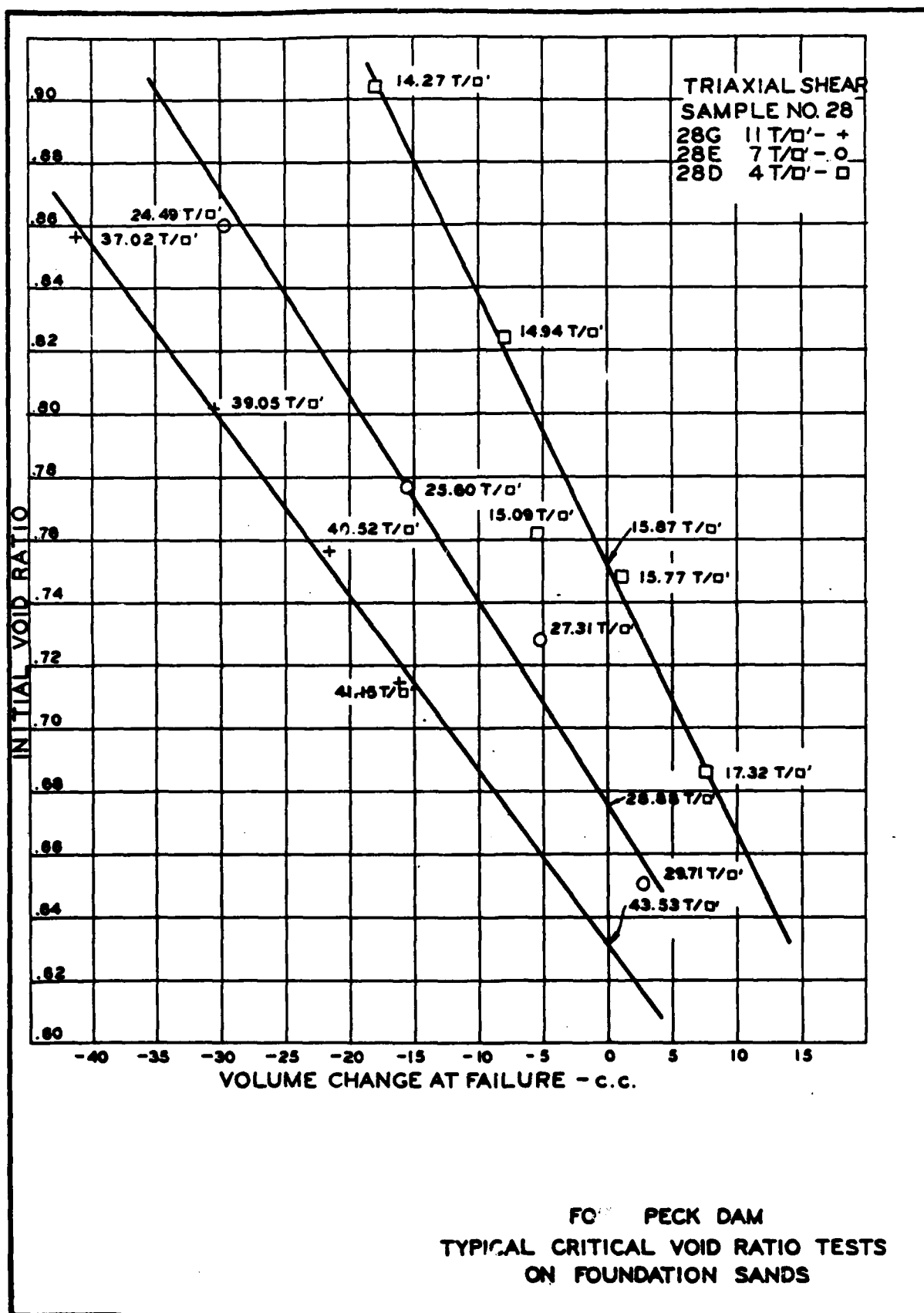
FORT PECK DAM
RELATIVE DENSITY TESTS
SHELL MATERIAL
TEST PIT 1

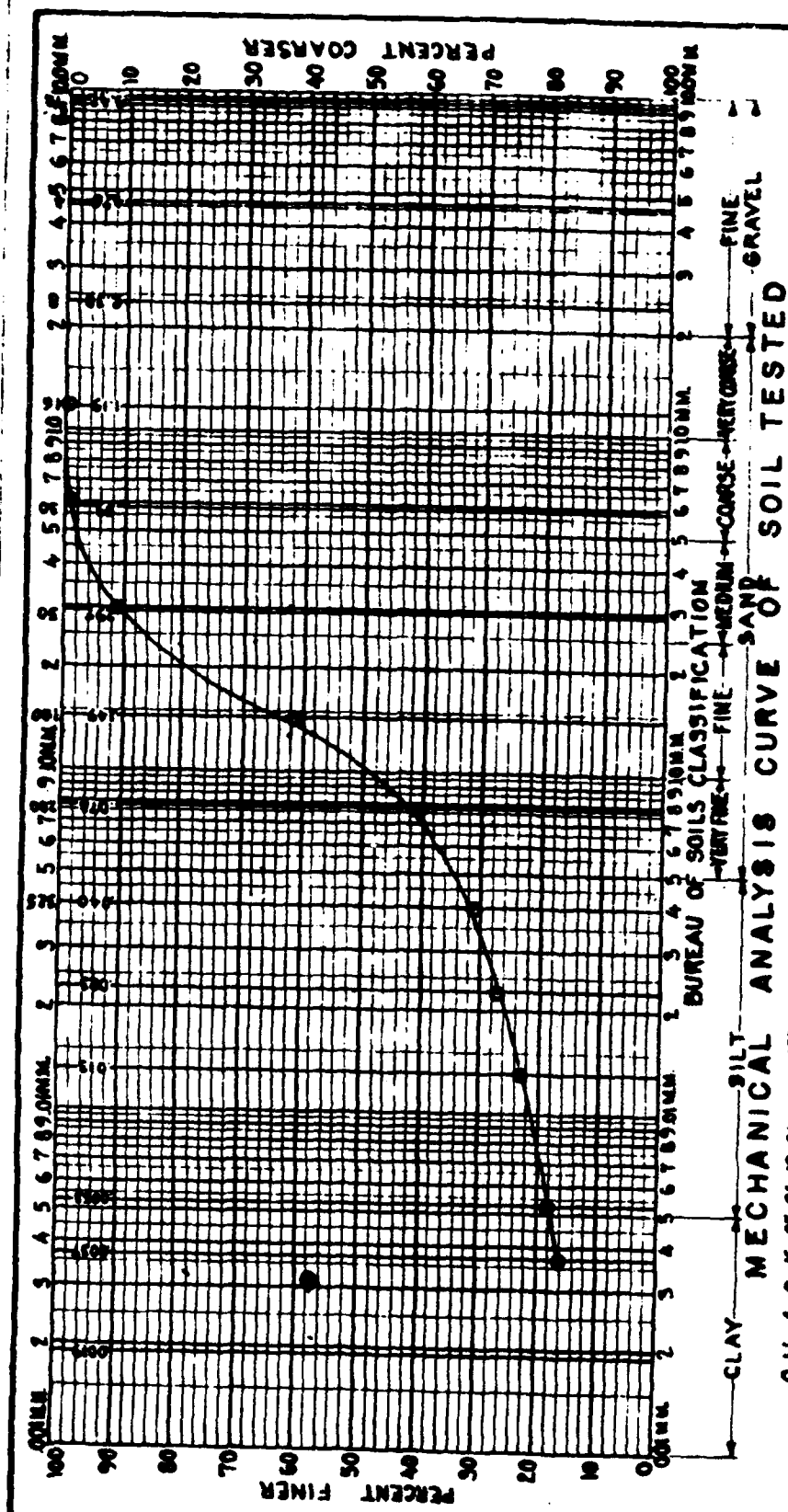




FORT PECK DAM
TYPICAL VOID RATIO CURVES FOR
UNDISTURBED AND REMOLDED SAMPLES
SHELL MATERIAL
TEST PIT 3

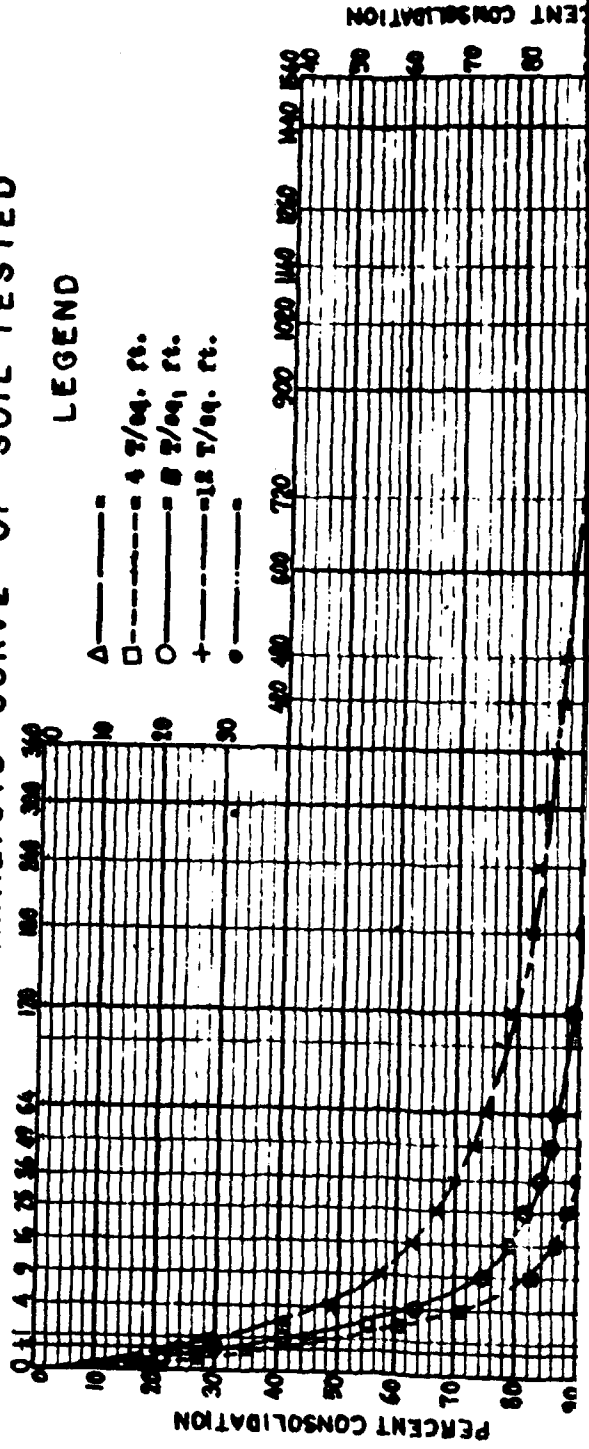


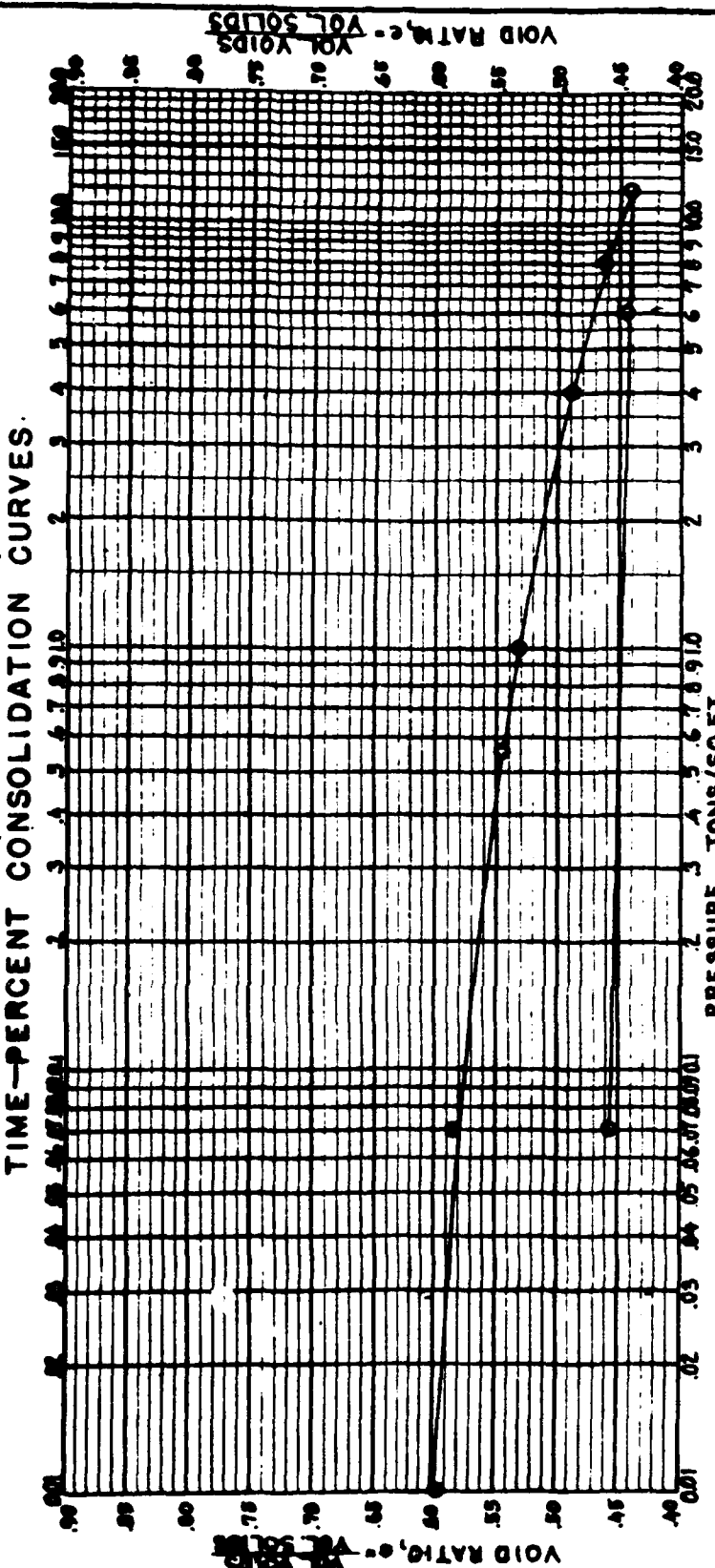
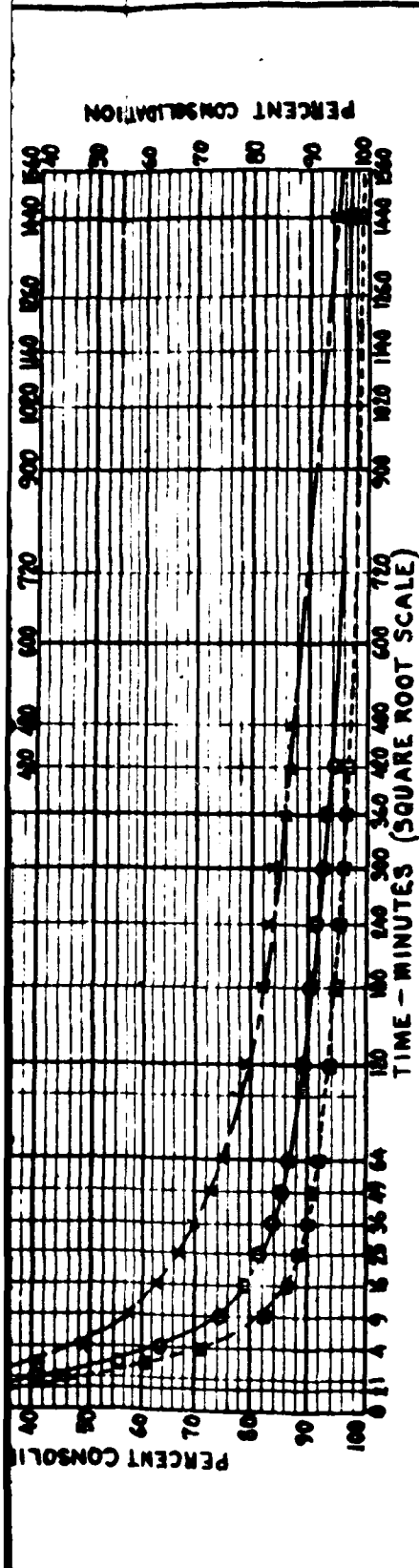




LEGEND

- △ --- 4 2/eq. ft.
- --- 8 2/eq. ft.
- --- 12 2/eq. ft.
- + --- 18 2/eq. ft.
- --- 24 2/eq. ft.





VERTICAL LOAD TONS/SQ. FT.	COMPACTION PERCENT
0.07	0
0.56	58
1.00	3.24
4.00	4.00
6.71	6.71
8.00	8.00
12.00	9.70
6.00	9.60
0.07	8.65

Estimated Previous Consolidation = Tons/Sq.Ft.

Undisturbed sample
Immersed in water during test
Station 60 + 00 Range 0 + 35D
Depth 13.5 Elev. 2234.2
Initial Thickness 2.50"
Cross Sectional Area of sample 24.8 sq. in.
Natural Moisture Content 23.0%
* Total compaction in percent of original height of sample.

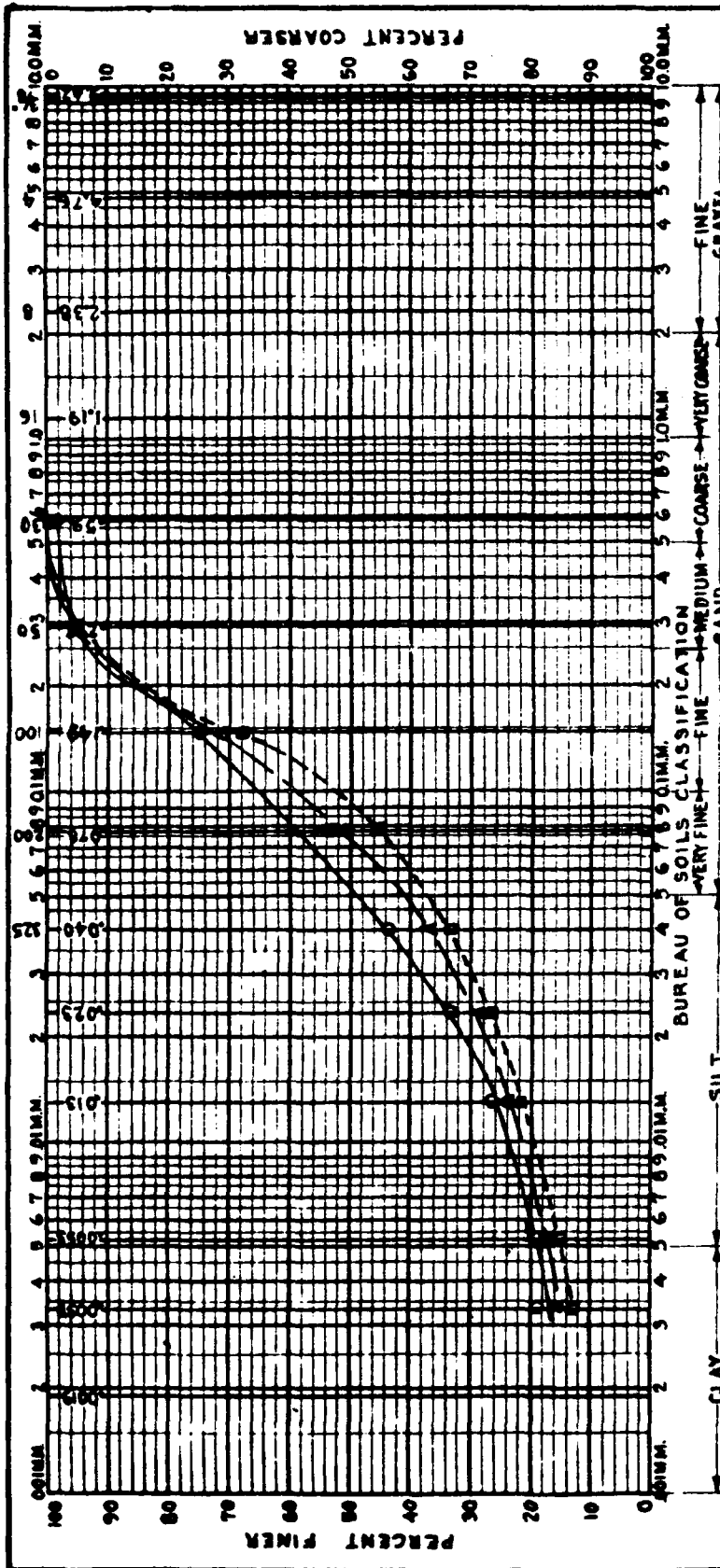
MISSOURI RIVER IMPROVEMENT
NAVIGATION, FLOOD CONTROL, POWER, IRRIGATION

FORT PECK DAM

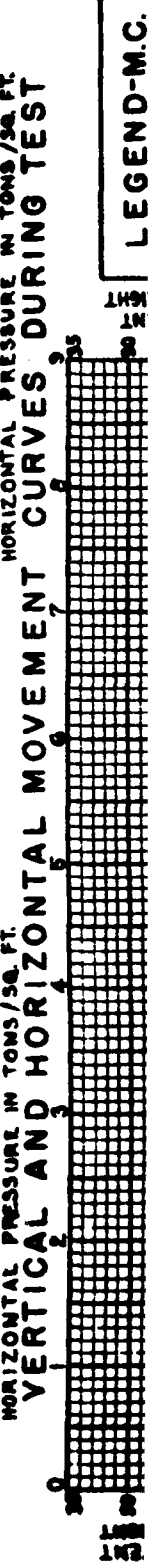
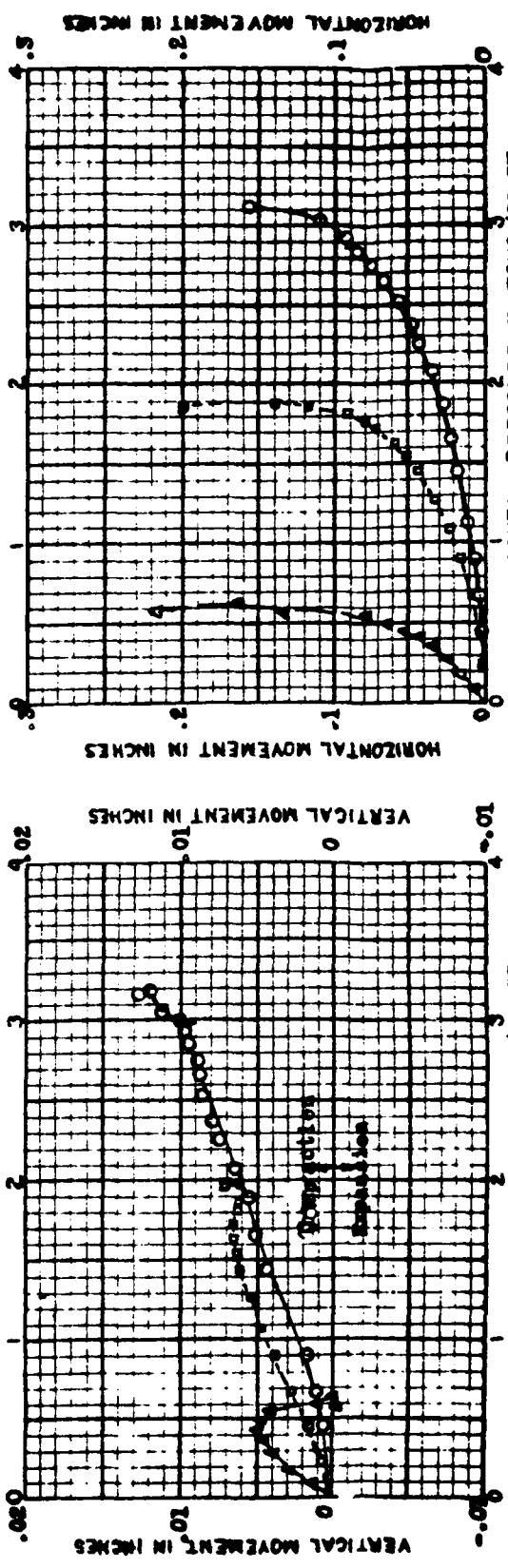
SLIDE INVESTIGATION
CONSOLIDATION TESTS ON CORE MATERIAL
HOLE C-7 - SAMPLE #2
U.S. ENGINEER OFFICE, FORT PECK, MONT. 12-18-36

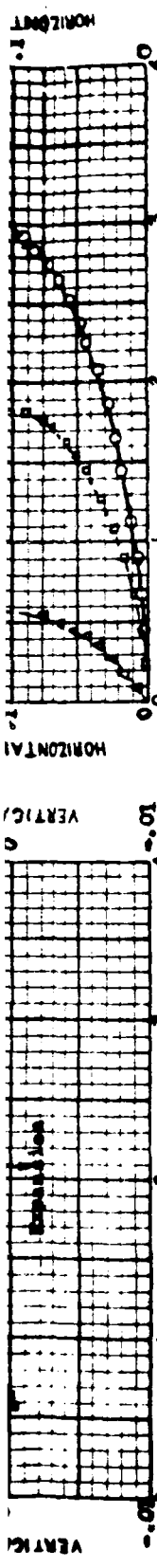
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Checked by: _____
Approved: _____

Drawn by: _____
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Approved: _____



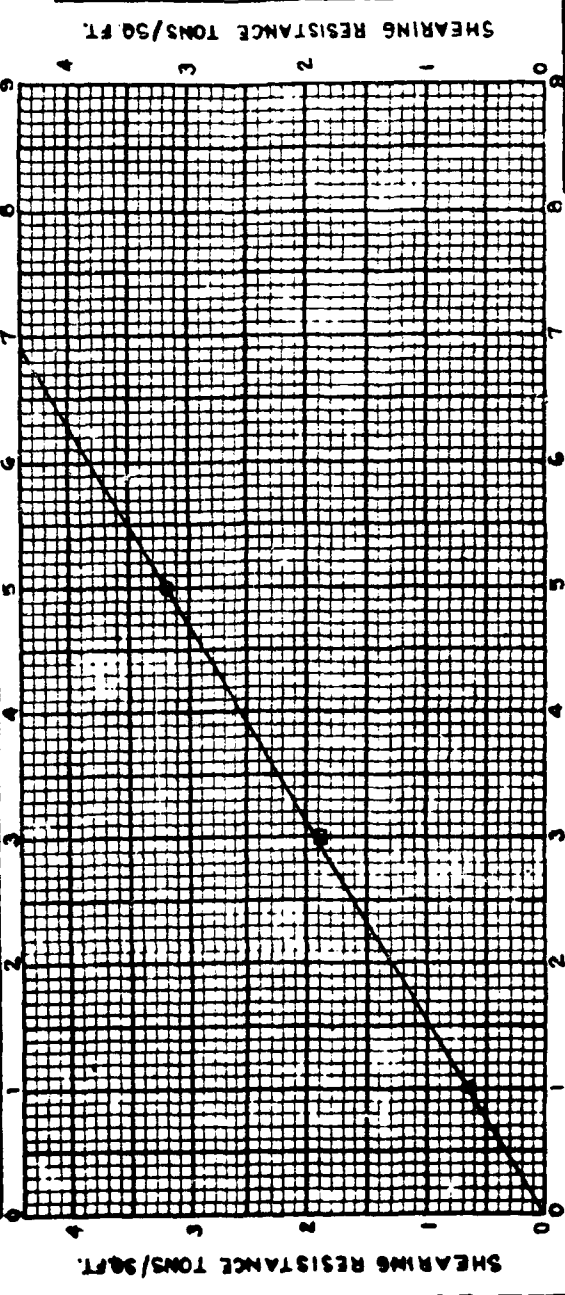
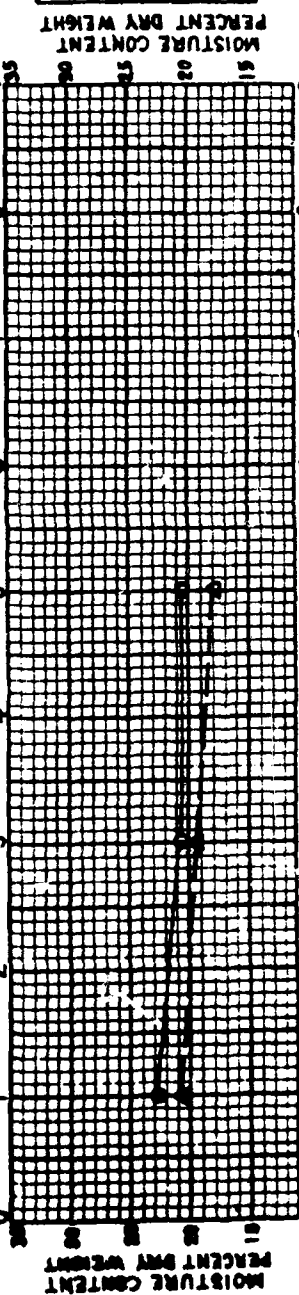
MECHANICAL ANALYSIS CURVE OF SOIL TESTED





HORIZONTAL PRESSURE IN TONS/SQ. FT.
VERTICAL AND HORIZONTAL MOVEMENT CURVES DURING TEST

LEGEND-M.C.	
Before Test	○
After Test	△



LEGEND	
△	1 T/sq. ft.
□	3 T/sq. ft.
○	5 T/sq. ft.
+	7 T/sq. ft.
●	9 T/sq. ft.

VERTICAL LOAD TONS/SQ. FT.
NORMAL LOAD-SHEARING RESISTANCE CURVE

MISSOURI RIVER IMPROVEMENT
NAVIGATION, FLOOD CONTROL, POWER, IRRIGATION

FORT PECK DAM

SLIDE INVESTIGATION
SHEAR TESTS ON CORE MATERIAL

HOLE C-7 - SAMPLE #3

U.S. ENGINEER OFFICE, FORT PECK, MONT 1-3-39

Submitted _____ Approved _____

Checked by _____

Traced by _____

File No. _____

Notes:

Undisturbed Sample

Consolidated Shear Tests

Increment Loading

Elevation 2233.1 - 2235.0

Depth 14.6 - 14.7

Gross Sectional Area of Sample 16.00 sq. in.

Initial Thickness 0.75 inch

Sample immersed in water during test

Station 60 + 00 Range 0 + 350

Shearing Resistance
Cohesion = 0.0 T/sq. ft.
c = Cohesion = 0.0 T/sq. ft.

φ = 32° 20'

A. GENERAL.

A comprehensive program of laboratory and field tests was made to determine the structural properties of the different types of materials in the damaged area, as well as in unaffected portions of the dam. These tests are grouped as follows:

Tests on overburden materials in the damaged area.

Tests on shell and transition zone material in unaffected portions of the dam.

Tests on typical foundation sands and clays.

Tests on core materials.

Tests on shale and bentonite.

These investigations are each discussed briefly.

1. Overburden materials in damaged area.

The overburden in the damaged area included both shell and foundation sands, as well as alluvial clays and masses of core material that became intermixed during the movement.

Mechanical analyses for classification purposes were performed on overburden samples from the churn-drill holes. Overburden cores from the Calyx holes were split and photographed, and then samples for laboratory tests were cut from one of the halves. These samples, consisting of 4-inch (102 mm) cubes, were carefully selected and cut to represent typical material from each core. Tests on these included mechanical analyses, specific gravity, moisture content, and determination of the natural voids in the material. The samples were prepared in a cold-storage room, packed with dry ice to keep them frozen, and transported to the laboratory for testing.

Two series of shear tests were made on samples of overburden from Calyx hole No. 4. Plates 5-4 and 5-5 give typical results of tests on overburden materials.

2. Shell and transition-zone materials in unaffected portions of dam. Samples of typical shell materials were secured from undisturbed portions of the shell immediately west of the damaged area and from three test pits, located along the 2212 upstream berm, driven down to the saturation line.

A continuous photographic record was kept of the stratification of the material in the deepest test pit. On all samples, the tests included mechanical analyses, specific gravity, relative density (both wet and dry), and determination of natural voids. In addition, triaxial tests were made on disturbed and on several undisturbed samples of typical shell material from one of the test pits.

In order to check the results of critical-density tests performed on the triaxial shear machines, several series of direct-shear tests were also performed and critical density determined by the Taylor method.

Undisturbed samples of material from the transition zone between the core and the upstream were secured from a shaft near the right end of the undamaged section. On these samples, mechanical analyses, critical-density tests, determination of natural voids, relative density tests, consolidation tests, and shear tests were performed. In addition to the physical tests, a complete mineralogical examination was made of a typical sample of shell material. Plates 5-6 through 5-13 give results of tests on these materials.

An experimental section of hydraulic fill was constructed to investigate the feasibility of placing this type of material by means of caterpillar tractors. This fill was placed in 6-inch (152 mm), 12-inch (305 mm), 18-inch (457 mm), and 24-inch (610 mm) layers to a depth of from 6 feet (1.8 m) to 8 feet (2.4 m). Each layer was compacted by three, six, or nine passes of a 95-horsepower tractor operating at half and full speed.

Continuous undisturbed samples were taken from test pits in each sampling area, and mechanical analyses, specific gravity, void determinations, relative-density tests were made on each sample. Results on these samples are shown on Plates 5-14 through 5-17.

3. Foundation sands and clays. A test pit was driven into the flood plane downstream from the dam in order to secure undisturbed samples of materials similar to the foundation materials in the section of the dam affected by the earthquake. A continuous photographic record was kept of the natural strata in this pit, and mechanical analyses, specific gravity, void determinations, relative density and critical-density tests were performed on this material.

Undisturbed samples of the surface clays were secured at the upstream edge of the damaged area. Mechanical analyses, consolidation tests, and consolidated-shear tests were performed on these samples. Plates 5-18 to 5-21 show the results of tests on foundation sands and clays.

4. Core materials. At a selected location in the closure section, the undamaged core on the left bank, and in the center of the slide area, 152-mm (6-inch) drive samples were taken down to the center of the core. Mechanical analyses, natural moisture content, consolidation tests, and consolidated-shear tests were performed on samples from 10-foot (3.0 m) intervals in elevation. In addition, triaxial tests, consolidation tests, and Atterberg tests were made on samples from elevations 2080 to 2090. The results of typical tests on core materials are given on Plates 5-22 to 5-24.

5. Shale and bentonite. Samples of shale and bentonite were secured from the

TESTS OF MATERIALS

Undisturbed samples of material from the transition zone between the core and the upstream shell were secured from a shaft near the east end of the undamaged section. On these samples, mechanical analyses, critical-density tests, determination of natural voids, relative density tests, consolidation tests, and shear tests were performed. In addition to the physical tests, a complete mineralogical examination was made of a typical sample of shell material. Plates 5-6 through 5-13 give results of tests on these materials.

An experimental section of hydraulic fill was constructed to investigate the feasibility of compacting this type of material by means of caterpillar tractors. This fill was placed in 6-inch (152 mm), 12-inch (305 mm), 18-inch (457 mm), and 24-inch (610 mm) layers to a depth of from 6 feet (1.8 m) to 3 feet (2.4 m). Each layer was compacted with three, six, or nine passes of a 95-horsepower tractor operating at half and full speed.

Continuous undisturbed samples were taken from test pits in each sampling area, and mechanical analysis, specific gravity, void determinations, and relative-density tests were made on each sample. Test results on these samples are shown on Plates 5-14 to 5-17.

3. Foundation sands and clays. A test pit was driven into the flood plane downstream from the dam, in order to secure undisturbed samples of alluvial materials similar to the foundation materials under the section of the dam affected by the earth movement. A continuous photographic record was kept of the natural strata in this pit, and mechanical analyses, specific gravity, void determinations, relative-density and critical-density tests were performed on this material.

Undisturbed samples of the surface clays were secured at the upstream edge of the damaged area, and mechanical analyses, consolidation tests, and consolidated-shear tests were performed on these samples. Plates 5-18 to 5-21 show the results of tests on foundation sands and clays.

4. Core materials. At a selected location in the closure section, the undamaged core on the right bank, and in the center of the slide area, 6-inch (152 mm) drive samples were taken down to the base of the core. Mechanical analyses, natural moisture content, consolidation tests, and consolidated-shear tests were performed on samples from 10-foot (3.0 m) intervals in elevation. In addition, triaxial-shear tests, consolidation tests, and Atterberg limit tests were made on samples from elevations 2170 to 2080. The results of typical tests on core material are given on Plates 5-22 to 5-24.

5. Shale and bentonite. Samples of weathered

shale were taken from the Calyx holes, from the Merriman drift above the inlet portals, and from several points in the damaged area, as well as from fly holes and a test pit driven into the weathered shale downstream from the damaged section. Samples of fault-zone material were also secured from the Crosby drift near the shafts. Mechanical analyses, consolidation tests, and both consolidated and quick-shear tests were performed on these samples.

Samples of bentonite were secured from Calyx holes, the Merriman drift, the Crosby drift, and from exposed seams at other points on the right abutment. Both quick and consolidated-shear tests were performed on these samples. The coefficient of friction of bentonite on shale was also determined for some samples. The results of these tests are given on Plates 5-25 to 5-30.

In addition to the laboratory tests on the bentonite, a series of shear tests was made in the field on the two bentonite seams in the Merriman drift. These seams were lying approximately horizontal and were separated by 8 inches (203 mm) of shale. Both the normal loads and shearing loads were applied by means of hydraulic jacks. The center section of shale was confined by a steel jacket, to prevent its being crushed by the vertical load and to properly distribute the shearing forces.

B. EQUIPMENT AND PROCEDURE FOR LABORATORY TESTS.

1. Mechanical analyses. All mechanical analyses were made by the sieve and hydrometer method and were usually run wet. Samples composed of distinctly different types of material, such as sand with quantities of shale fragments or clay balls and clay samples mixed with gravel, were segregated and the percentage of each kind of material determined separately. These samples were run dry.

2. Specific-gravity determinations. Specific-gravity determinations were made on material from every sample, so that void determinations could be made more accurately. Specific-gravity determinations were made by the vacuum method on 200-gram samples.

3. Void determinations. For the purpose of determining the natural void ratio in undisturbed samples of materials from the shells, transition zones, foundation sands, and the experimental rolled hydraulic fill, 6-inch-diameter (152 mm) samples were taken in accurately calibrated cylinders 6 inches (152 mm) in length.

Void determinations of material from the frozen Calyx cores were made on the 4-inch (102 mm) cubes. The volume of the cubes was accurately determined by submerging them in a pan filled to the overflow with mercury and weighing the mercury displaced.

4. Relative-density tests. Relative-density tests

were performed on all undisturbed material, transition-zone material from the test pit in the dam, as well as on all samples rolled hydraulic fill. The large density tests made it necessary to use a special device for compacting to density. This apparatus consisted of tubes containing the samples, placed on the pedestals and sealed and down by cams on a motor-driven drum, the lowest possible density materials were carefully deposited through specially designed density tests were made on each sample in its natural and saturated condition.

5. Critical-density tests.

On shell materials were performed in the laboratory of the Graduate School of Engineering, Harvard University, at the Watlington, Vicksburg, Miss., and a strict laboratory. Tests on cohesionless materials were made in the laboratory.

6. Consolidation tests. All were made according to standard Fort Peck type of consolidation tests. Samples of transition-zone material were all 5-5/8 inches (143 mm) in thickness, while samples of core material, such as clays and silts, were 1.0 inch (25 mm) or 1-1/4 inches (31.8 mm) thick.

Consolidation of core and transition-zone samples prior to making shear tests was made in consolidation devices, although bentonite and weather-shale samples were consolidated directly in the shear box.

7. Shear tests. Consolidated transition-zone material, bentonite, and shale samples were made in the Zanesville-type shear machine. All quick-shear tests on core material were made in the Zanesville-type shear machine. All quick-shear test samples were 4 inches (102 mm) thick.

Consolidated shear tests were made by loading the sample to the desired density, then applying the shearing loads in increments. Quick-shear tests were made by constant strain loading, the load was applied gradually, so that failure occurred within a few minutes after start of the test.

taken from the Calyx shales, from the Merriman drift, and from several other points in the damaged area, as well as from five test pits driven into the weathered stream from the damaged section. Samples of material were also secured from the area near the shafts. Mechanical analyses, consolidation tests, and both consolidated and unconsolidated shear tests were performed on these samples. Samples of bentonite were secured from Calyx, Merriman drift, the Crosby drift, and from seams at other points on the right bank. Both quick and consolidated-shear tests were performed on these samples. The coefficient of friction of bentonite on shale was also determined on some samples. The results of these tests are given in Plates 5-25 to 5-30.

In addition to the laboratory tests on the bentonites, shear tests were made in the field on bentonite seams in the Merriman drift. These seams were lying approximately horizontal and were covered by 3 inches (203 mm) of shale. Both vertical loads and shearing loads were applied by hydraulic jacks. The center section of the test was confined by a steel jacket, to prevent crushing by the vertical load and to propagate the shearing forces.

MATERIAL AND PROCEDURE FOR LABORATORY TESTS.

Gravimetric analyses. All mechanical analyses were made by the sieve and hydrometer method and by the pycnometer method. Samples composed of distinct types of material, such as sand with shale fragments or clay balls and gravel mixed with shale, were segregated and the weight of each kind of material determined. These samples were run dry.

Specific-gravity determinations. Specific-gravity determinations were made on material from the test pits, so that void determinations could be made accurately. Specific-gravity determinations were made by the vacuum method on 200-gram samples.

Void determinations. For the purpose of determining the natural void ratio in undisturbed samples, materials from the shells, transition zone sands, and the experimental hydraulic fill, 6-inch-diameter (152 mm) samples were taken in accurately calibrated cylinders (152 mm) in length.

Void determinations of material from the frozen samples. Void determinations were made on the 4-inch (102 mm) cubes. The void ratio of the cubes was accurately determined by weighing them in a pan filled to the overflow with mercury and weighing the mercury displaced.

Relative-density tests. Relative-density tests

were performed on all undisturbed samples of shell material, transition-zone material, and sandy material from the test pit in the flood plane below the dam, as well as on all samples from the experimental rolled hydraulic fill. The large number of relative-density tests made it necessary to construct a special device for compacting the samples to maximum density. This apparatus consisted of several pedestals, on which the tubes containing the samples were placed, the pedestals and samples being jarred up and down by cams on a motor-driven shaft. For determining the lowest possible degree of compaction, the materials were carefully deposited in glass cylinders through specially designed funnels. Relative-density tests were made on each sample in both dry and saturated condition.

5. Critical-density tests. Critical-density tests on shell materials were performed in the soils laboratory of the Graduate School of Engineering of Harvard University, at the Waterways Experiment Station, Vicksburg, Miss., and at the Fort Peck District laboratory. Tests on undisturbed samples of cohesionless materials were made at the Fort Peck laboratory.

6. Consolidation tests. All consolidation tests were made according to standard procedure in the Fort Peck type of consolidation equipment. Samples were all 5-5/8 inches (143 mm) in diameter. Samples of transition-zone material and the more pervious samples of core material were 2-1/2 inches (64 mm) in thickness, while samples of very impervious materials, such as clays and weathered shale, were 1.0 inch (25 mm) or 1-1/4 inches (32 mm) thick.

Consolidation of core and a few weathered-shale samples prior to making shear tests was accomplished in consolidation devices, although most of the bentonite and weather-shale samples were preconsolidated directly in the shear boxes.

7. Shear tests. Consolidated-shear tests on transition-zone material, weathered shale and bentonite were made in the M.I.T. shear machine, while the direct-shear tests on shell material and tests on core material were made in the Zanesville-type shear machine. All quick-shear tests were made in the Zanesville-type shear machine. The shear test samples were 4 inches (102 mm) square and 3/4-inch (19 mm) thick.

Consolidated shear tests were made by first consolidating the sample to the desired load and then adding the shearing loads in increments and waiting until movement ceased before adding additional load increments. Quick-shear tests were made with constant strain loading, the load being applied continuously, so that failure occurred within a few minutes after start of the test.

3

WAR DEPARTMENT

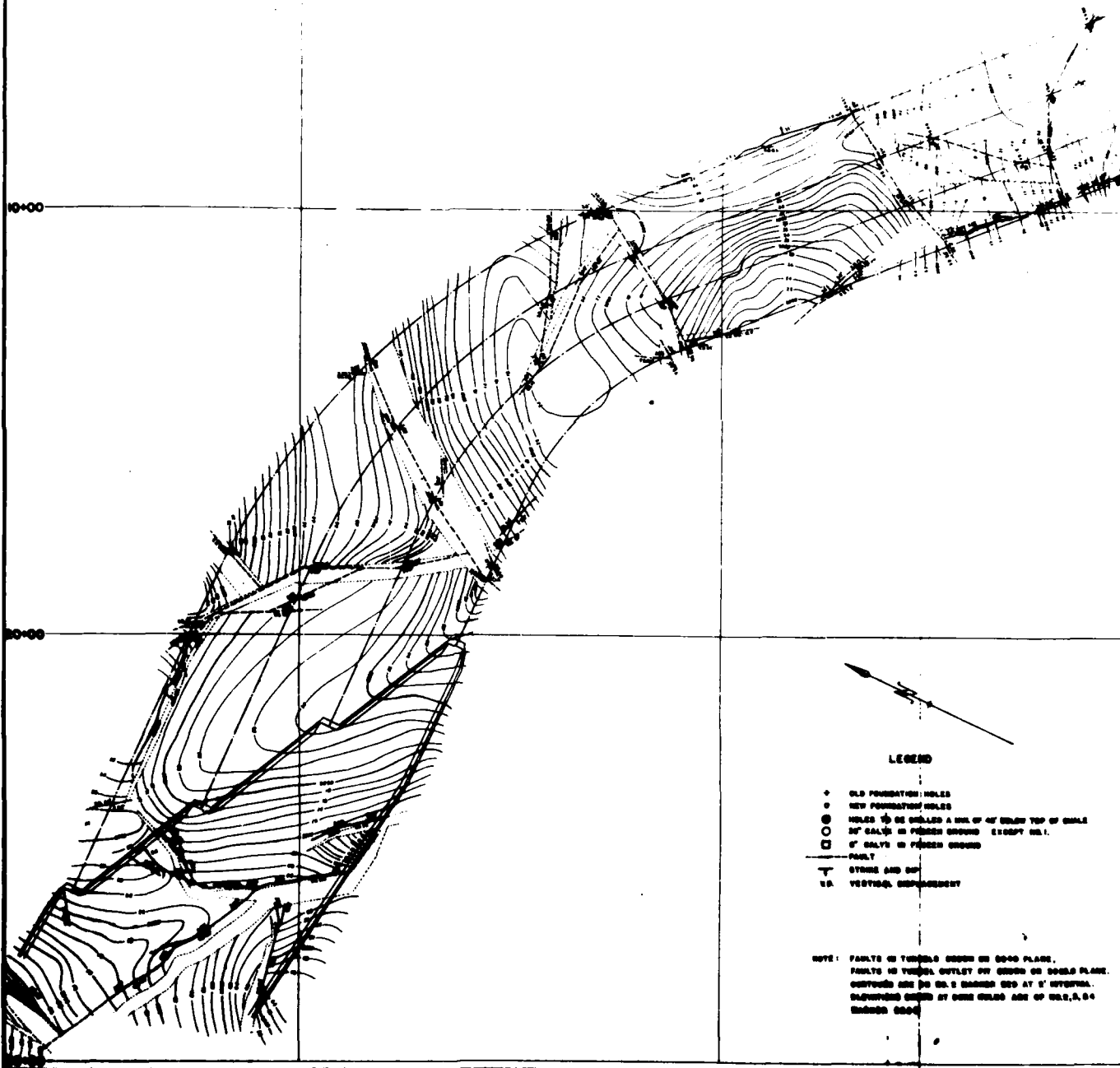
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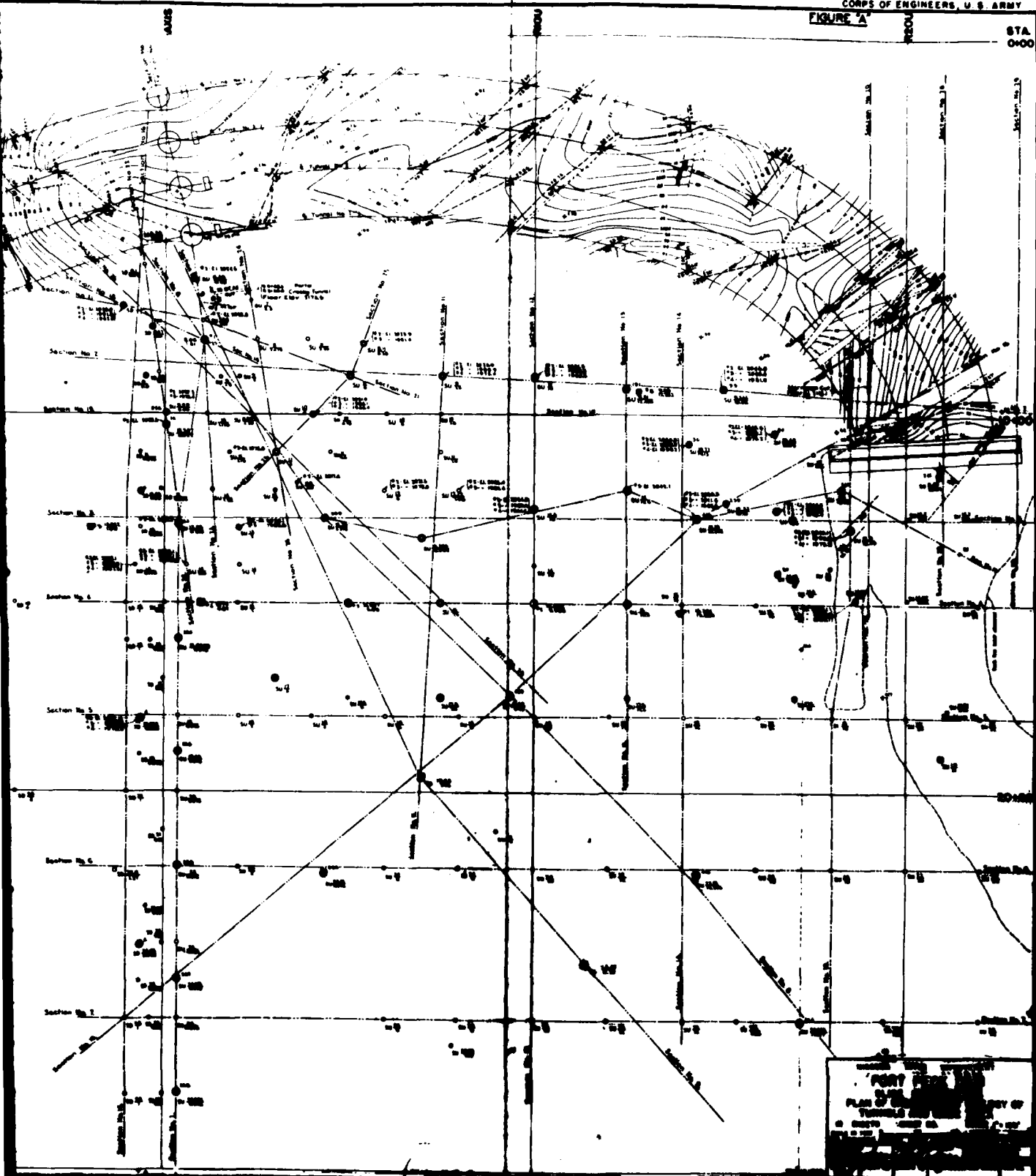
20+00



LEGEND

- OLD FOUNDATION HOLES
- NEW FOUNDATION HOLES
- HOLES 1/2" OR SMALLER A HOLE OF 1/2" OR SMALLER TOP OF HOLE
- 1/2" GALT IN FINDER GROUND EXCEPT HOLE
- 1/2" GALT IN FINDER GROUND
- FAULT
- T STONE AND WY
- 1A VESTED, DEPENDENT

NOTE: FAULTS IN TUNNELS SHOWN IN 50+00 PLANE.
 FAULTS IN TUNNEL OUTLET ON GROUND ON 50+00 PLANE.
 DISTANCES ARE IN FEET. SHOWN ON AT 1' INTERVAL.
 DISTANCES SHOWN AT ONE HUNDRED FEET OF 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000.



WAR DEPARTMENT

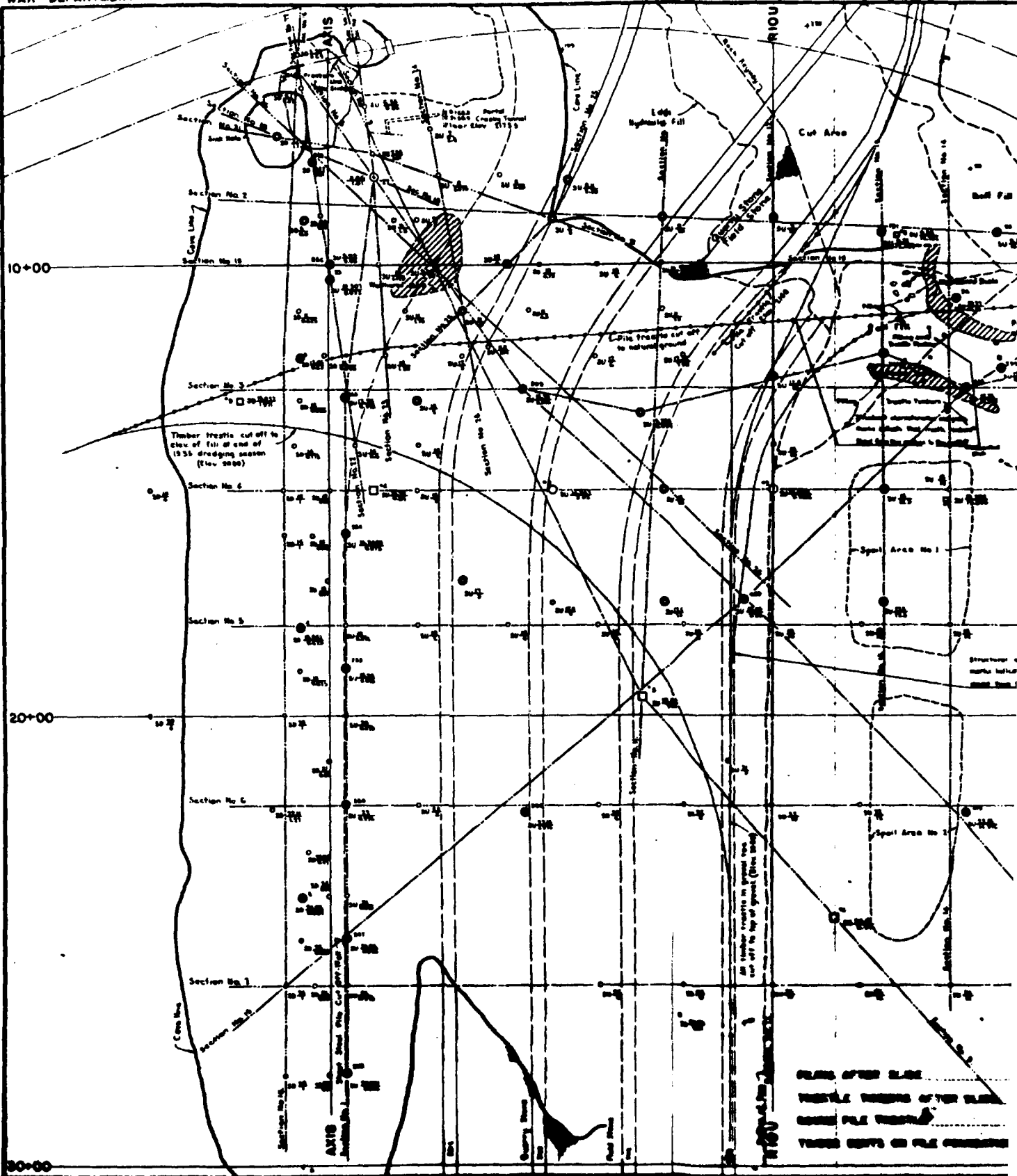
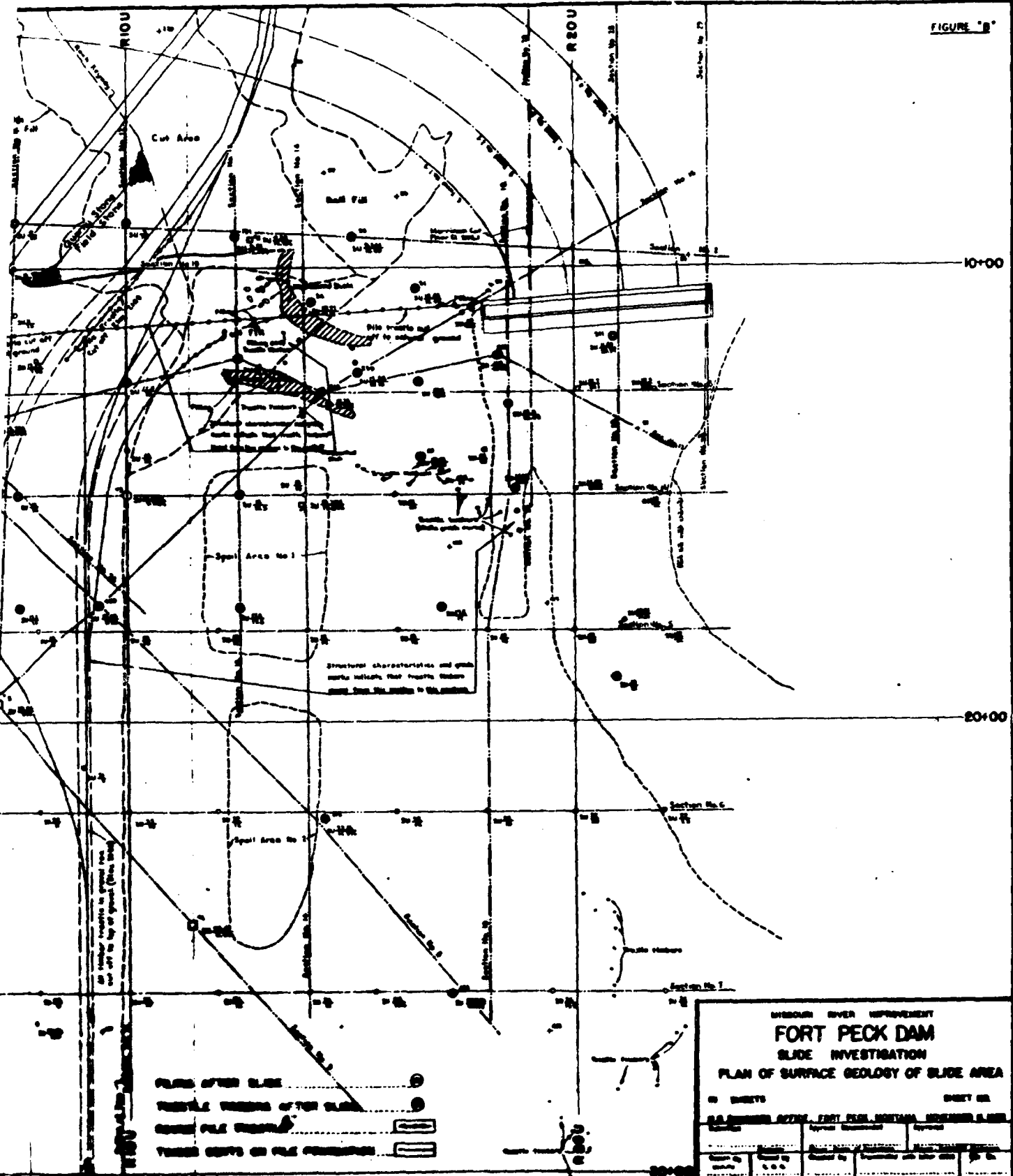
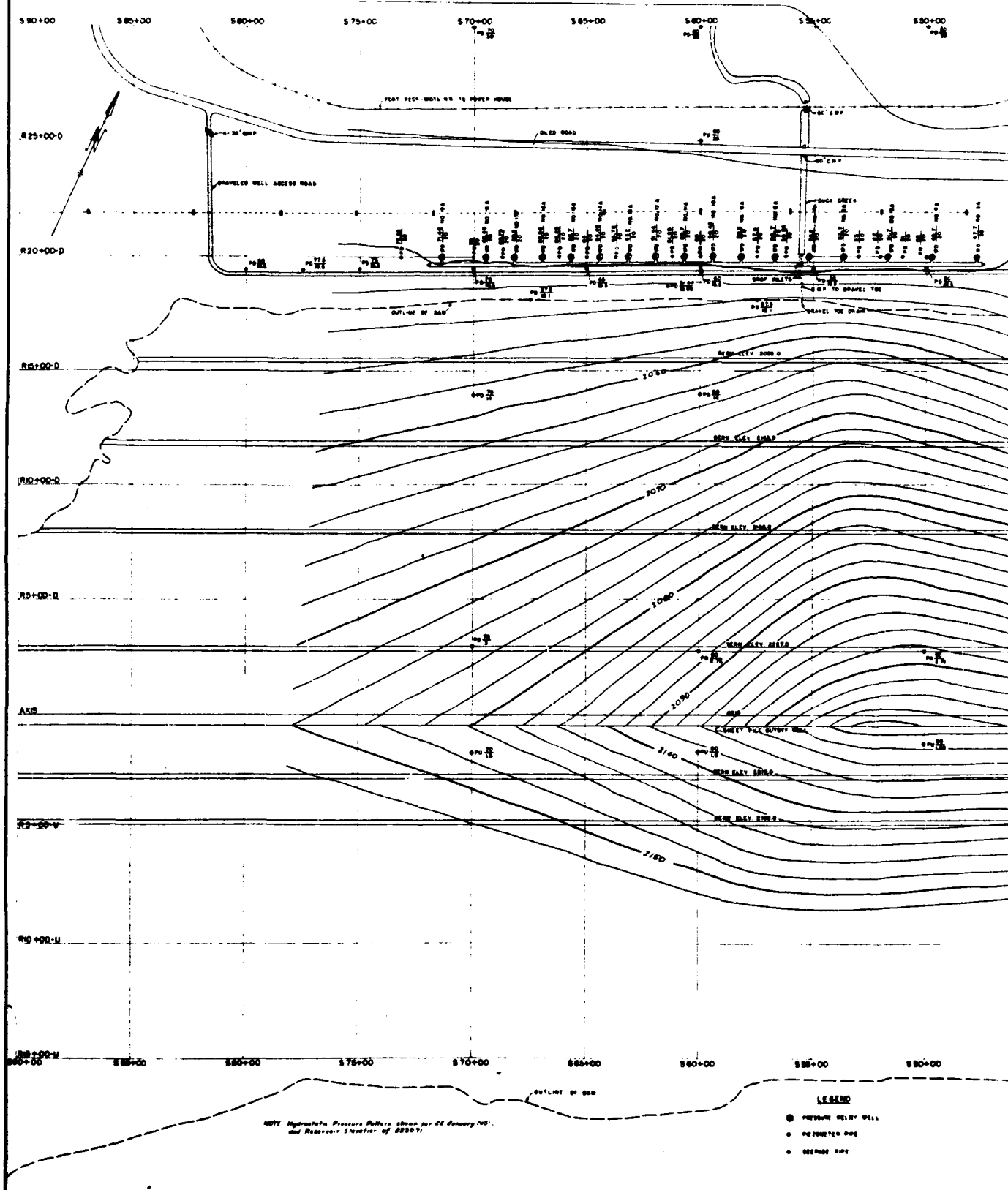


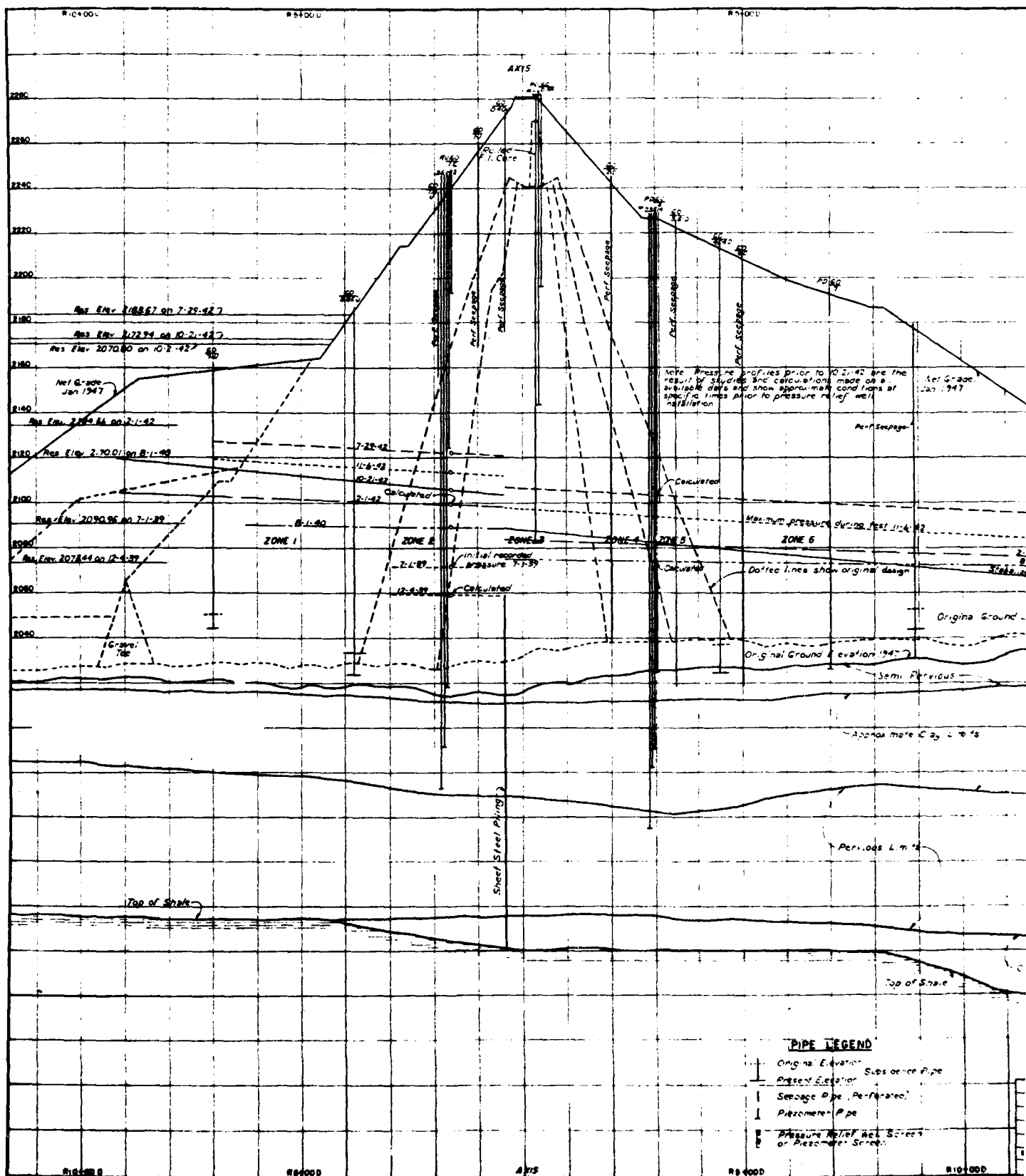
FIGURE "B"

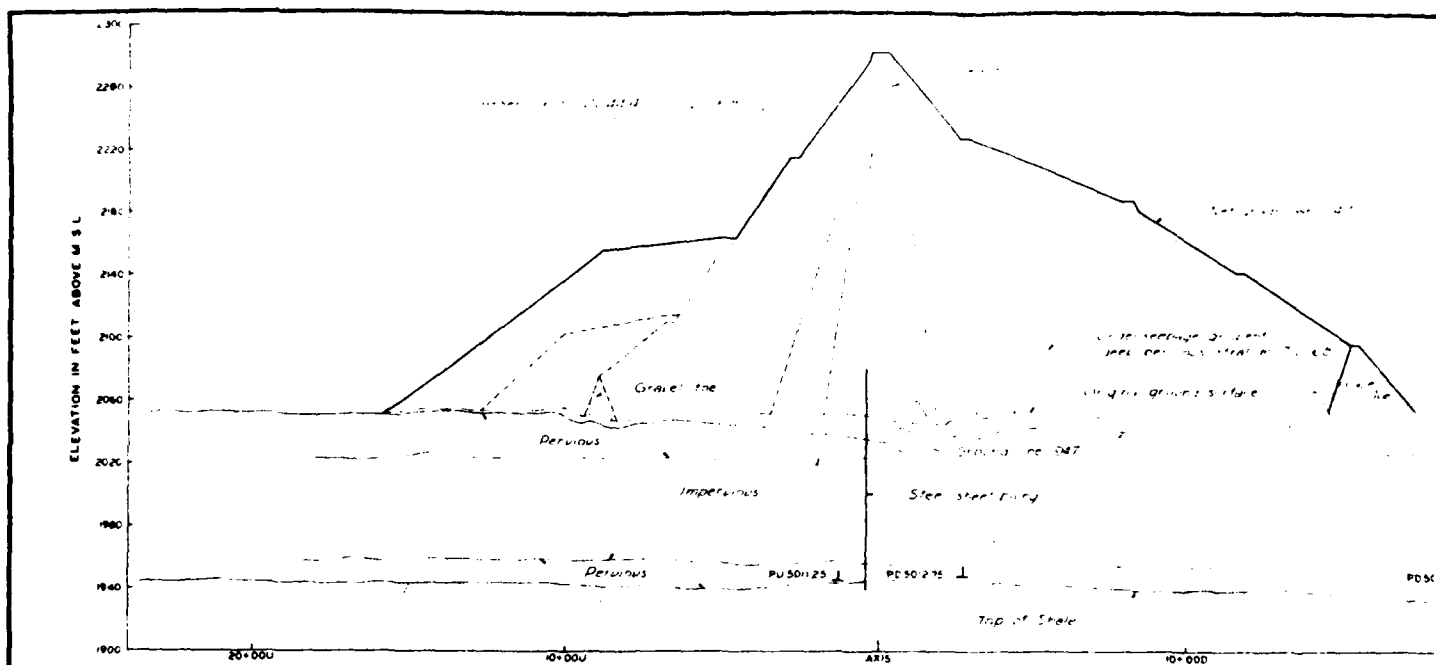




NOTE: Hydrostatic Pressure Profile shown per 22 January 1981 and Reservoir Elevation of 2250 ft.

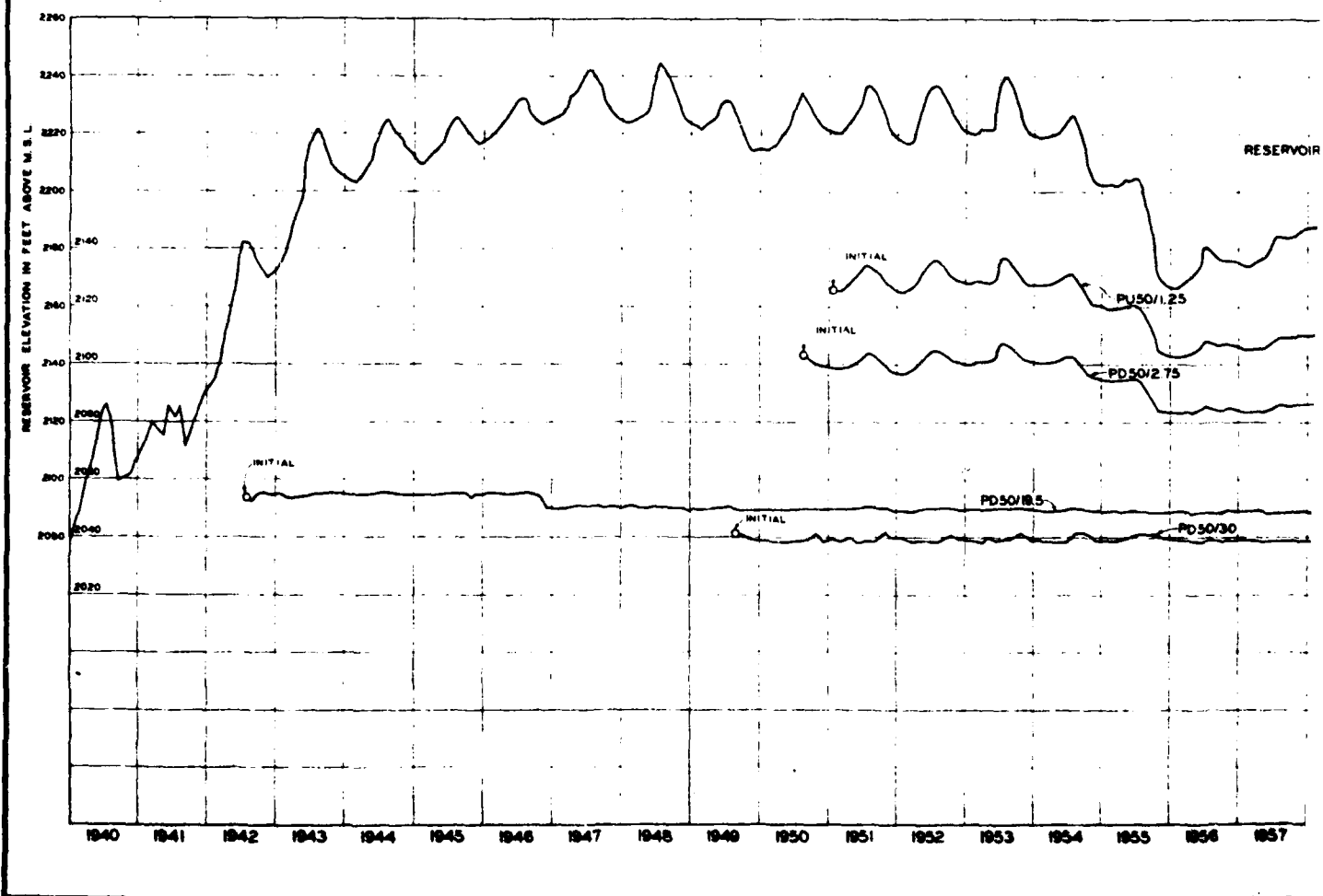
- LEGEND**
- PRESSURE RELIEF WELL
 - PIPE JOINTS
 - PIPE JOINTS
 - PIPE JOINTS





SECTION STA 50+00

SCALE VERT 1 INCH = 40 FEET
HORIZ 1 INCH = 200 FEET



AD A-134 914

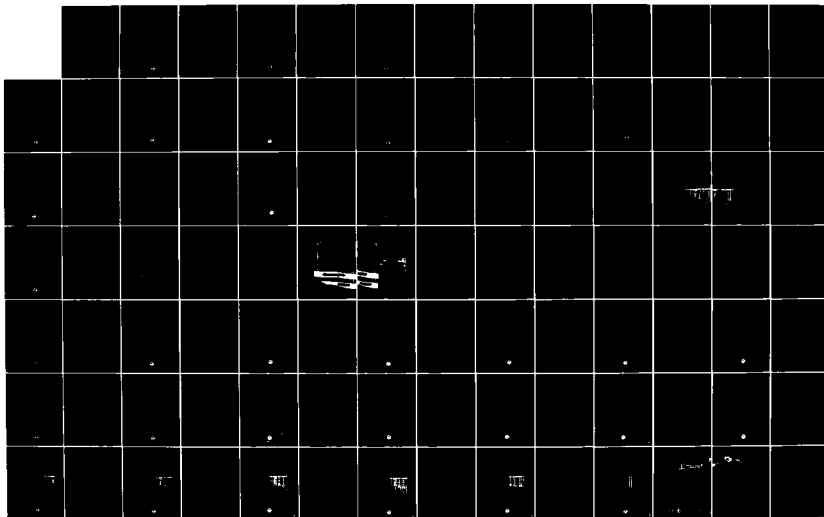
CONSTRUCTION FOUNDATION REPORT MISSOURI RIVER FORT PECK
MONTANA VOLUME 2 DRAWINGS(I) ARMY ENGINEER DISTRICT
OMAHA NE JAN 83

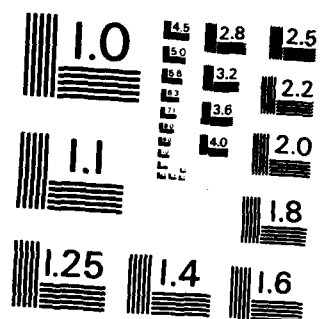
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UNCLASSIFIED

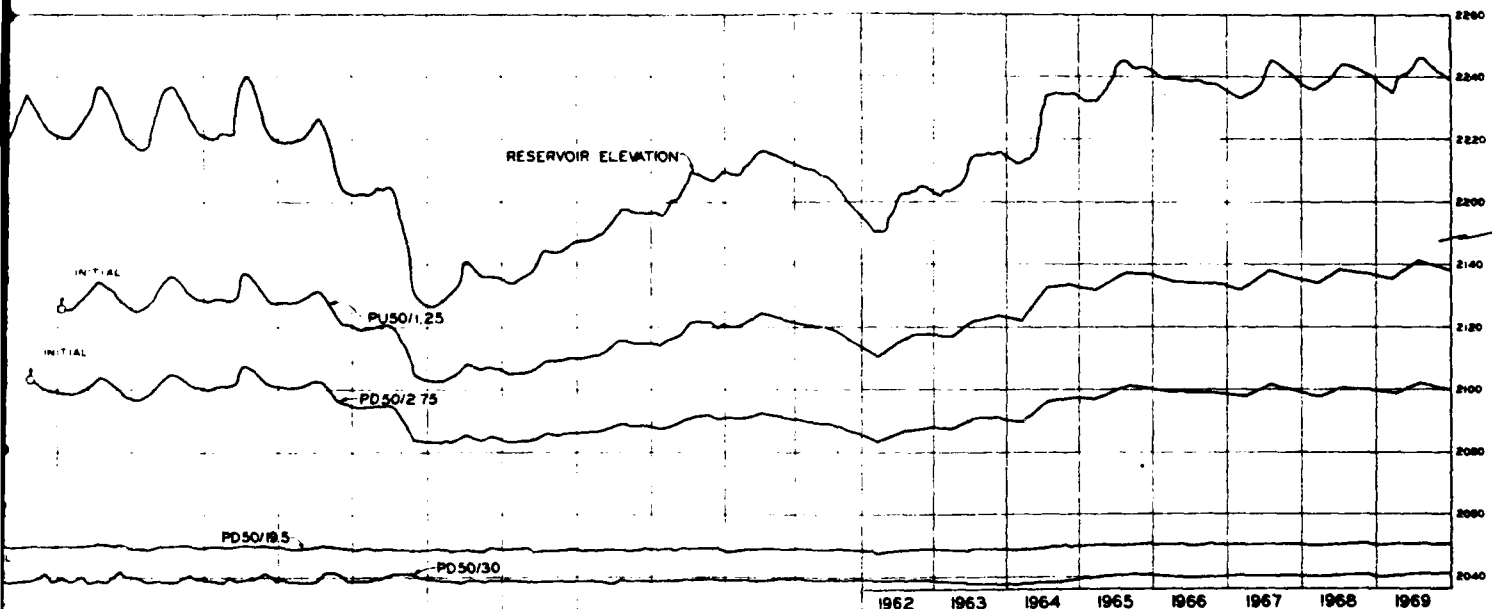
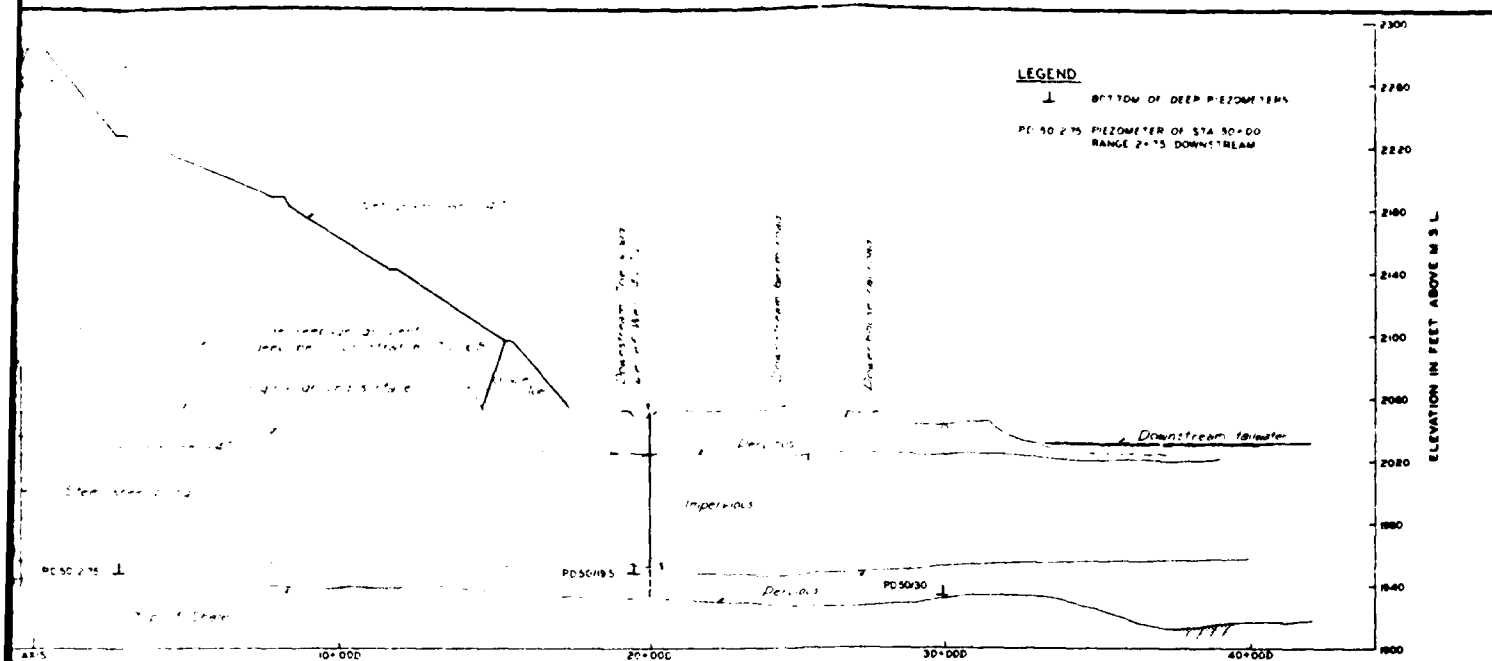
F/G 13/13

NL






MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS - 1963-A



1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
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THIS PLAN ACCOMPANIES CONTRACT NO. _____

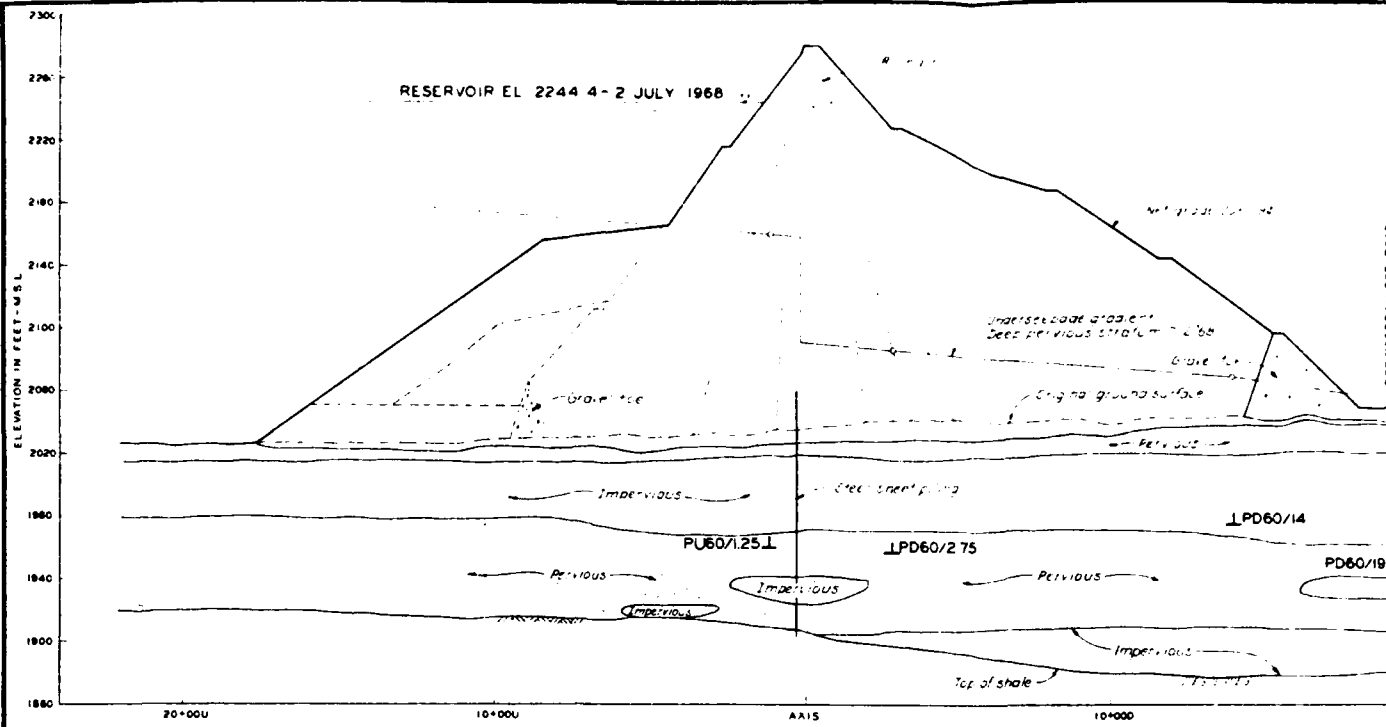
MODIFICATION NO. _____



U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

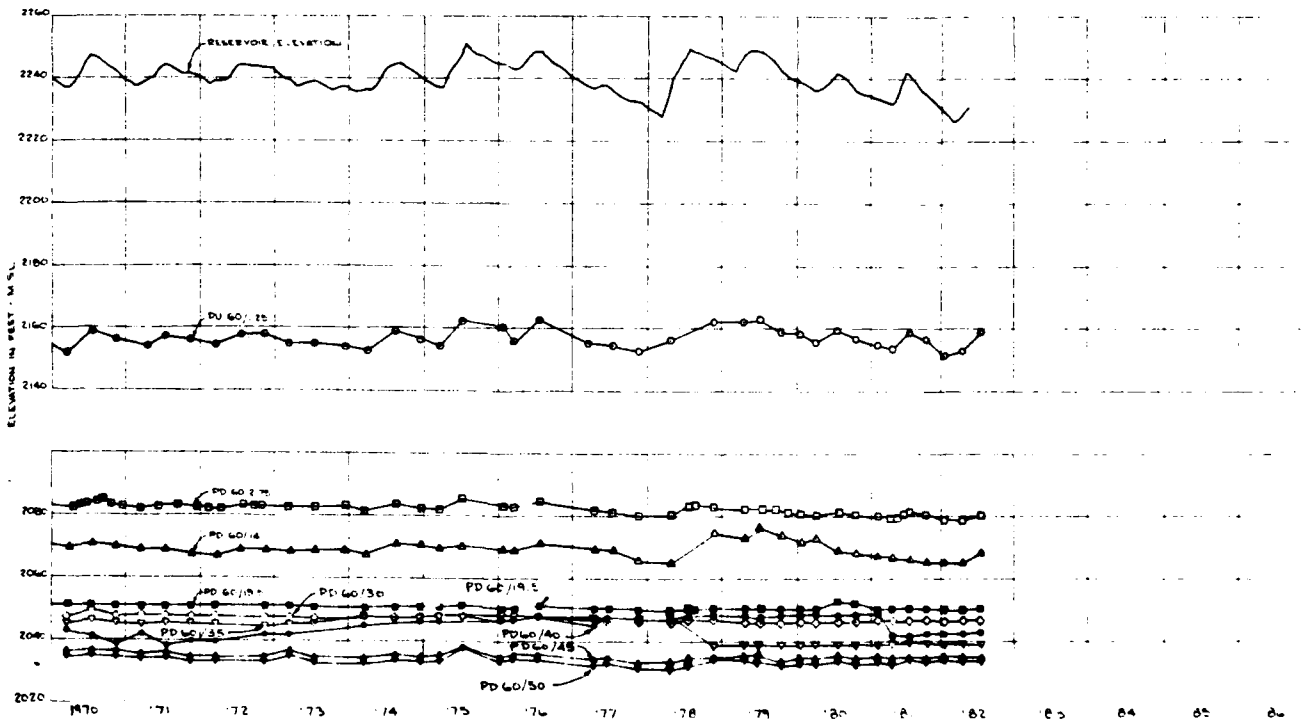
MISSOURI RIVER
FORT PECK LAKE, MONTANA
STATION 50+00
HYDROSTATIC PRESSURE
BENEATH CLAY STRATUM

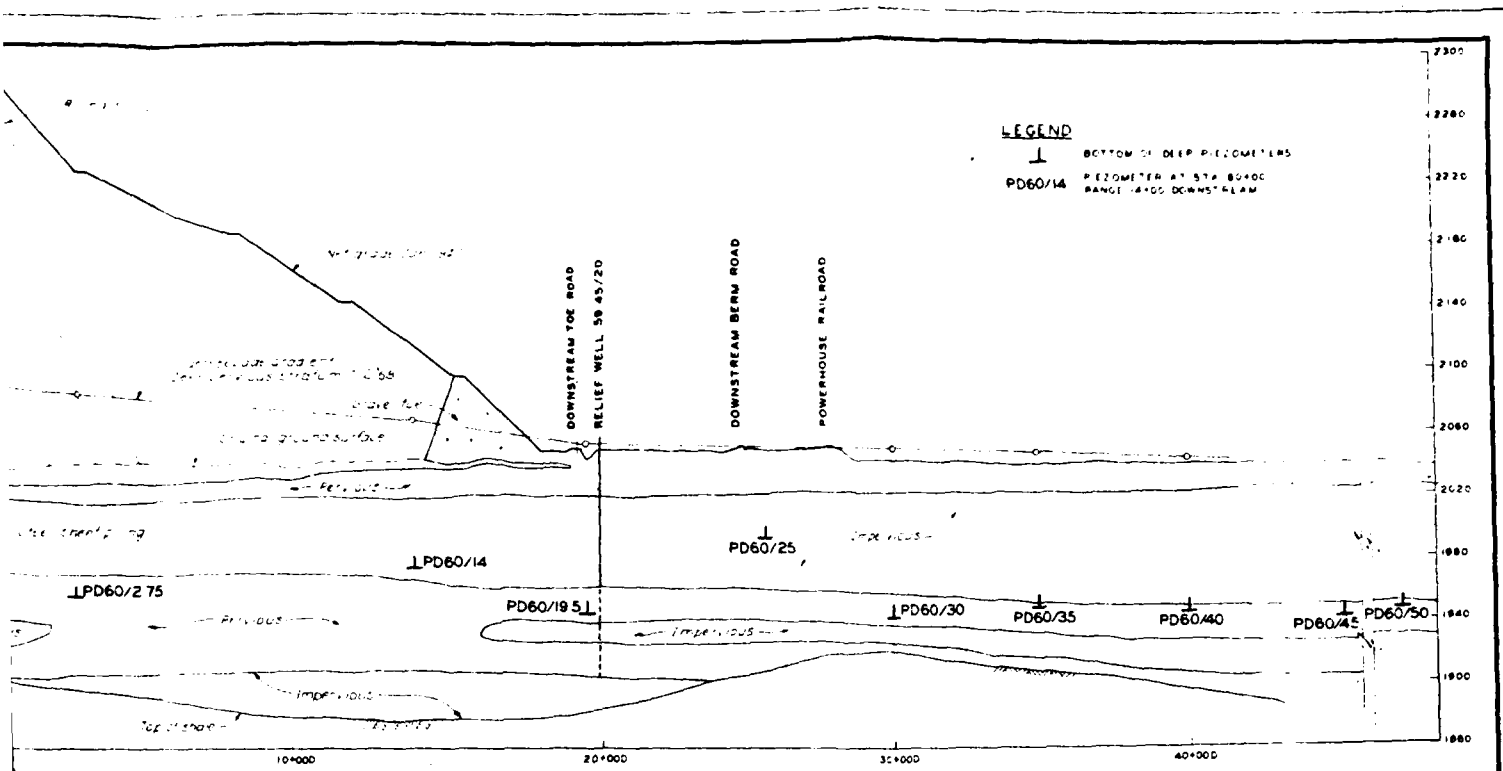
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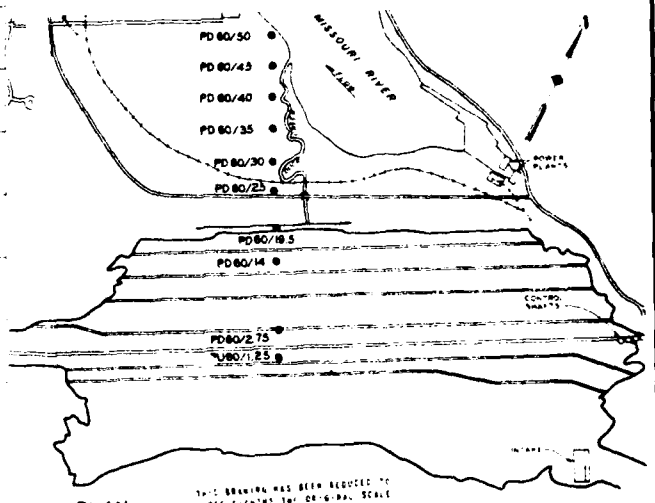
SECTION - STA 60+00

VERT. 1 INCH = 40 FEET
SCALE HORIZ. 1 INCH = 200 FEET





SECTION-STA 60+00
 SCALE VERT INCH=40 FEET
 HORIZ INCH=200 FEET



KEY PLAN

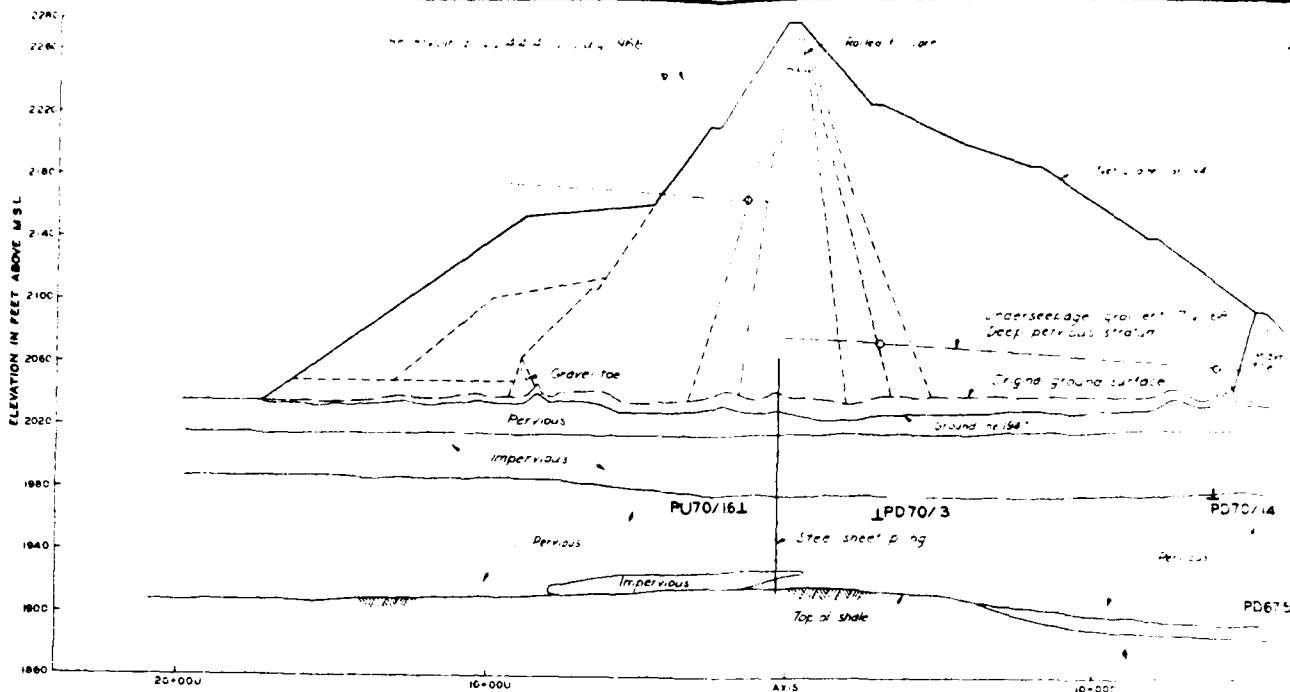
THIS DRAWING HAS BEEN REDUCED TO
 THREE-FIFTHS THE ORIGINAL SCALE

REVISIONS		DATE	BY	APPROVED
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA				
MISSOURI RIVER FORT PECK LAKE, MONTANA				
STATION 60+00 HYDROSTATIC PRESSURE BENEATH CLAY STRATUM				
DESIGNED BY	CHECKED BY	DATE		
DRAWN BY	APPROVED	DATE		
SCALE AS SHOWN	DATE			



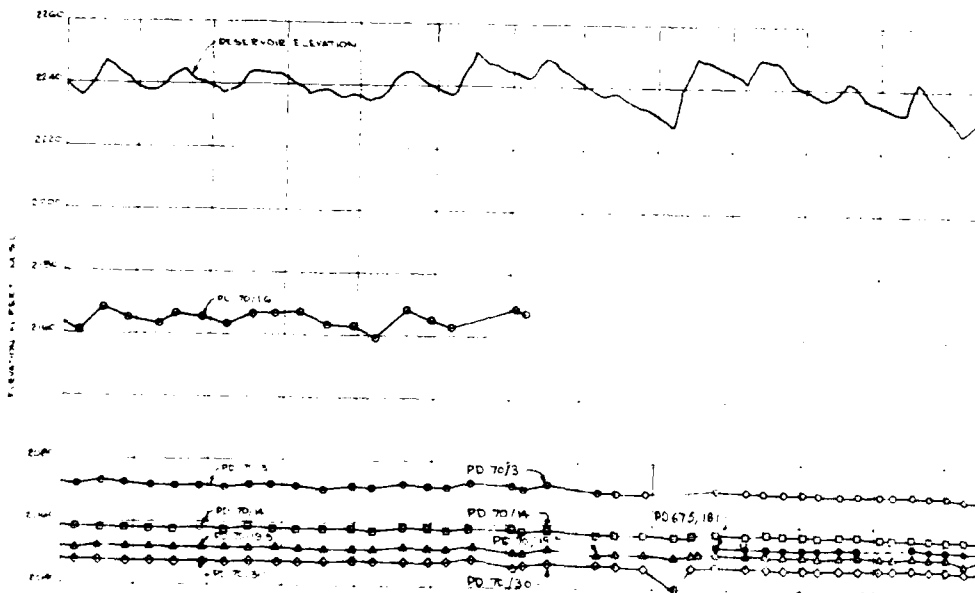
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 MODIFICATION NO.

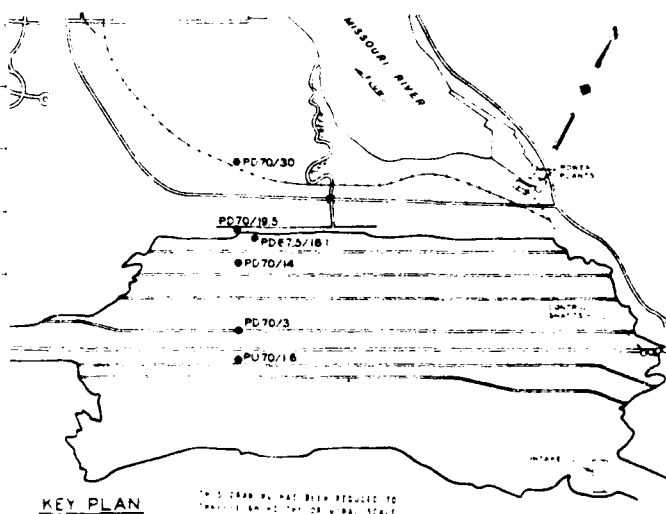
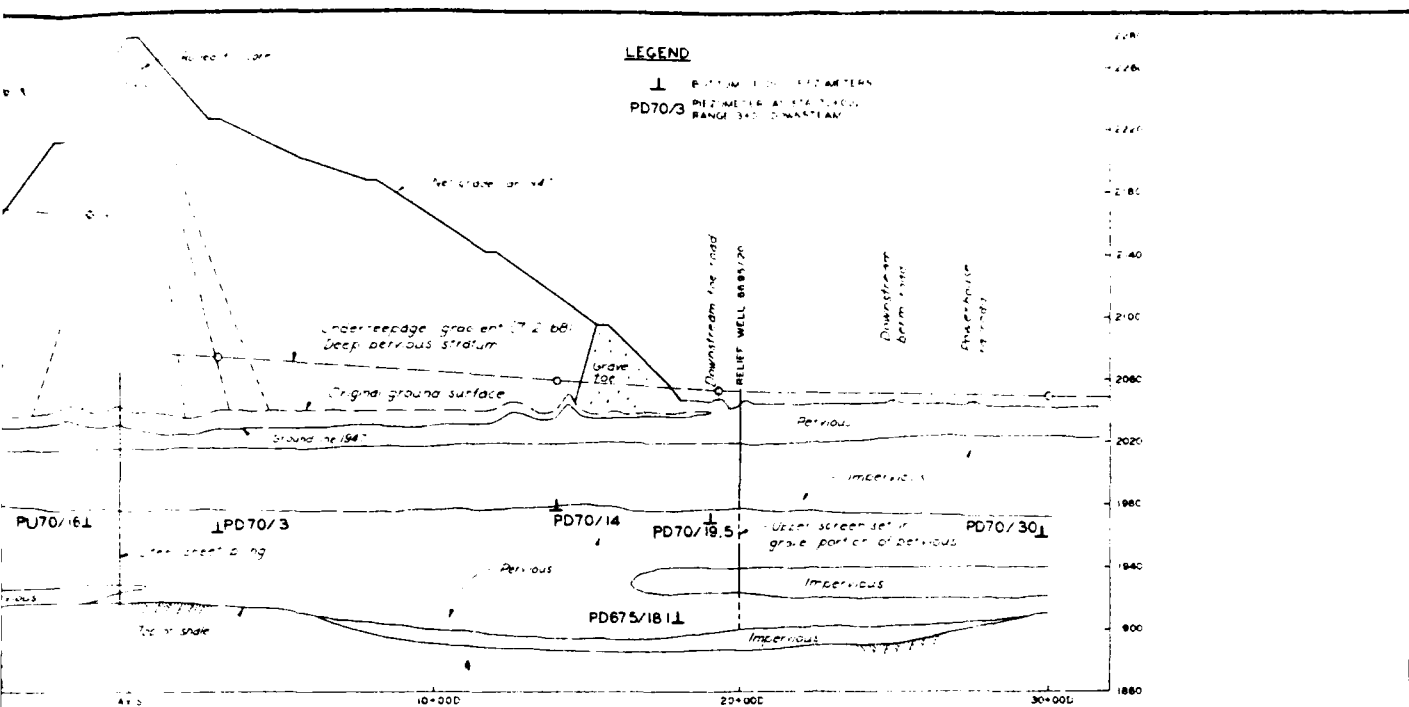
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SECTION STA 70+00

SCALE VERT 1 INCH = 40 FEET
HORIZ 1 INCH = 200 FEET



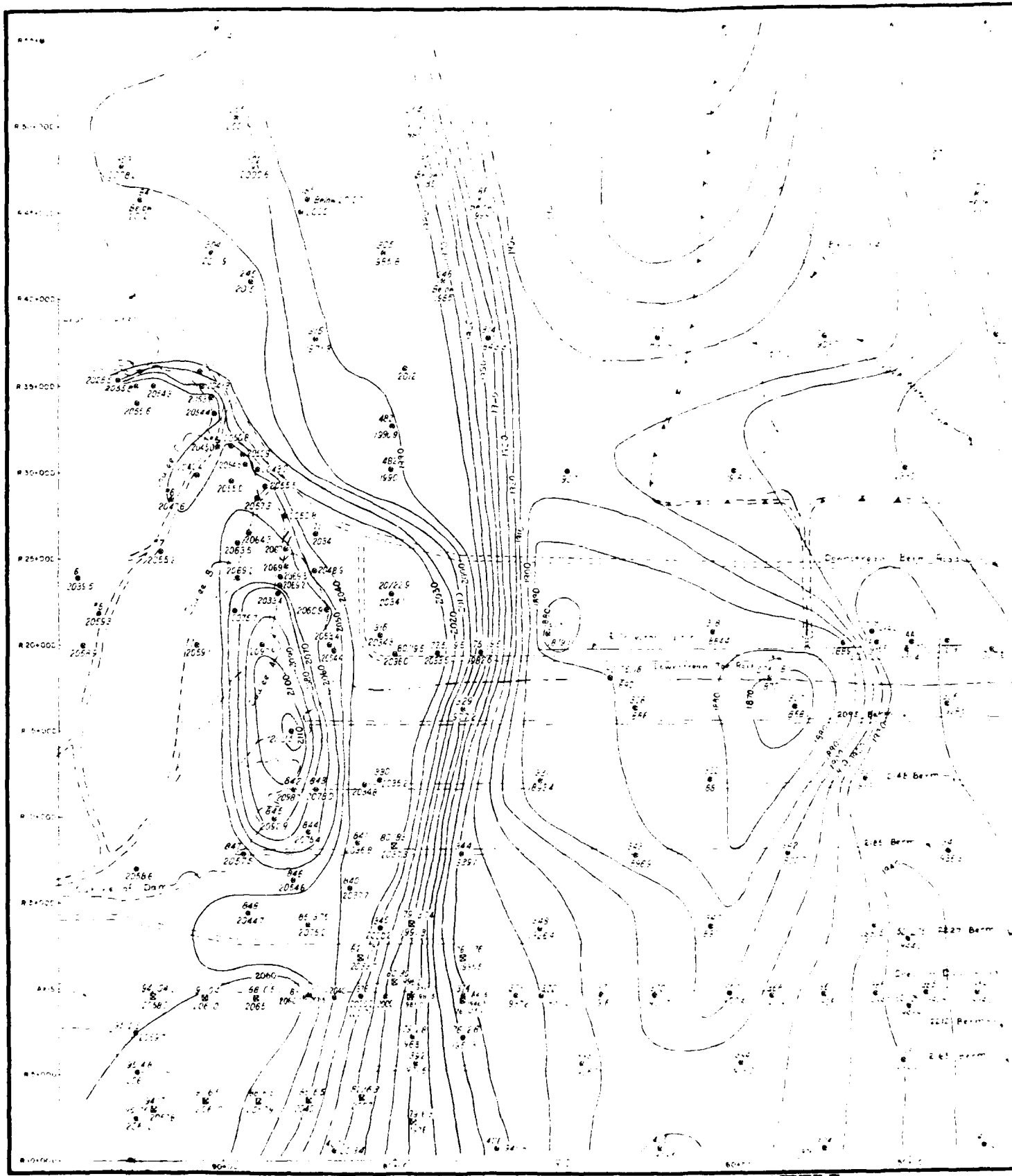


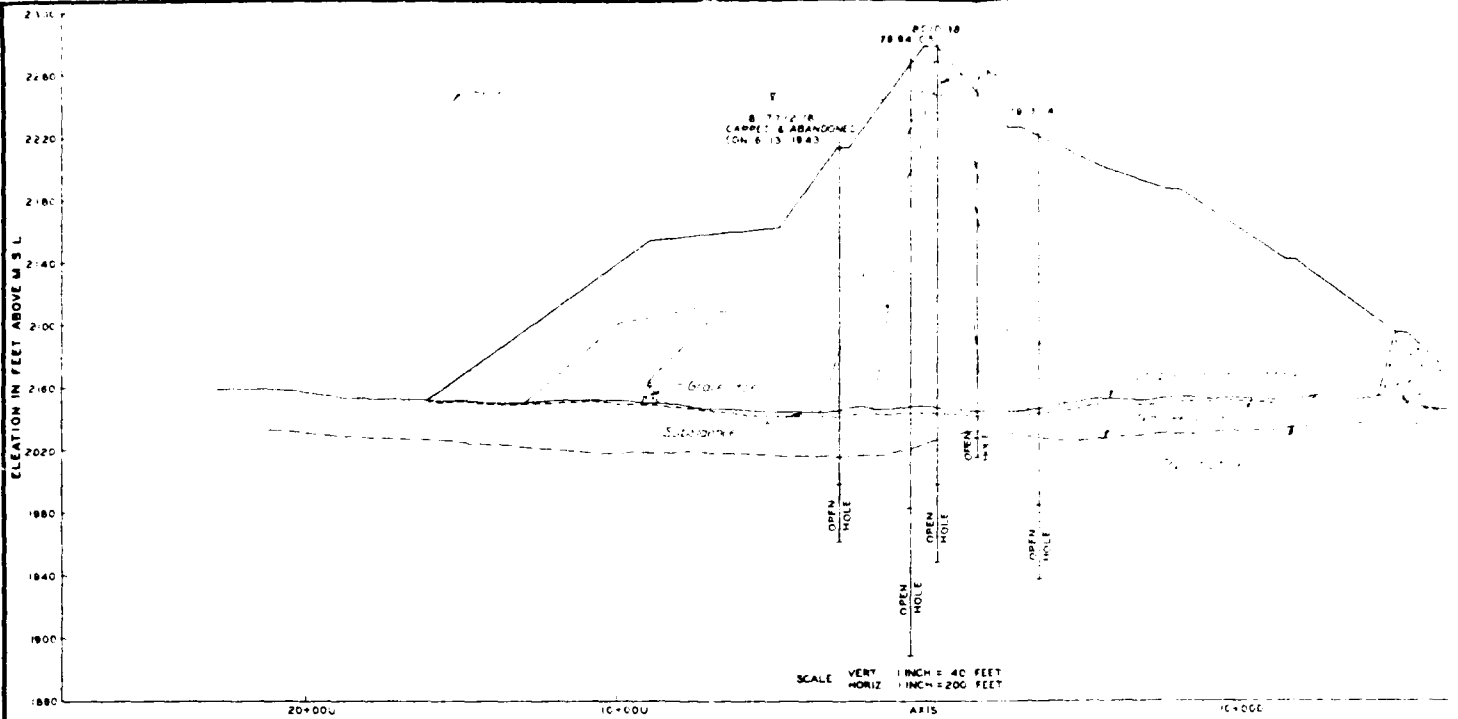
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MODIFICATION NO.

DATE	REVISION	NAME	APPROVED
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA			
DESIGNED BY	MICHAEL P. LEE		
DRAWN BY	FORT PECK LAKE MONTANA		
CHECKED BY	STATION 70+00		
REVIEWED BY	HYDROSTATIC PRESSURE		
DATE	BENEATH CLAY STRATUM		
APPROVED	DATE	BY	
APPROVED	DATE	BY	
APPROVED	DATE	BY	

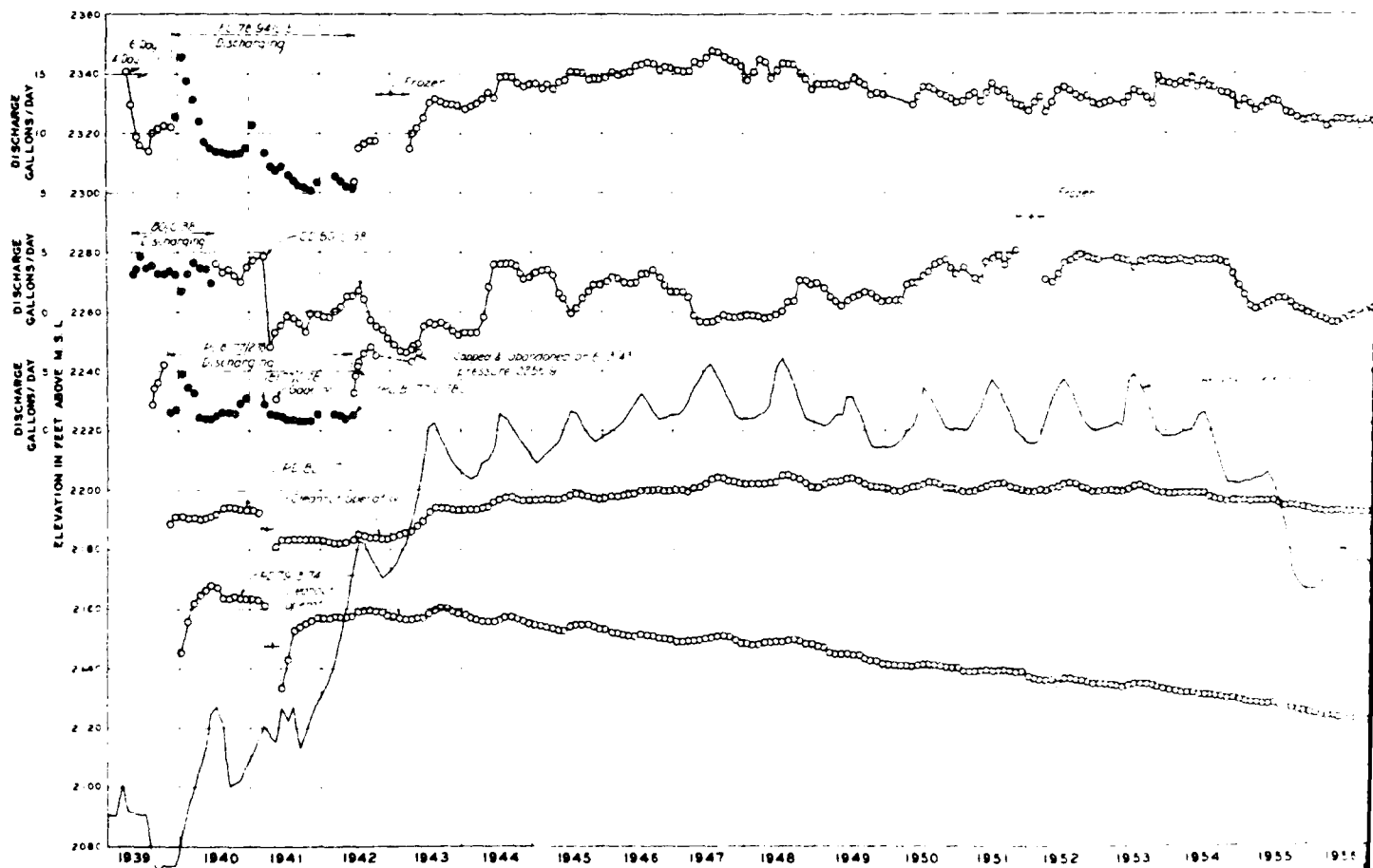
CONSTRUCTION FOUNDATION REPORT

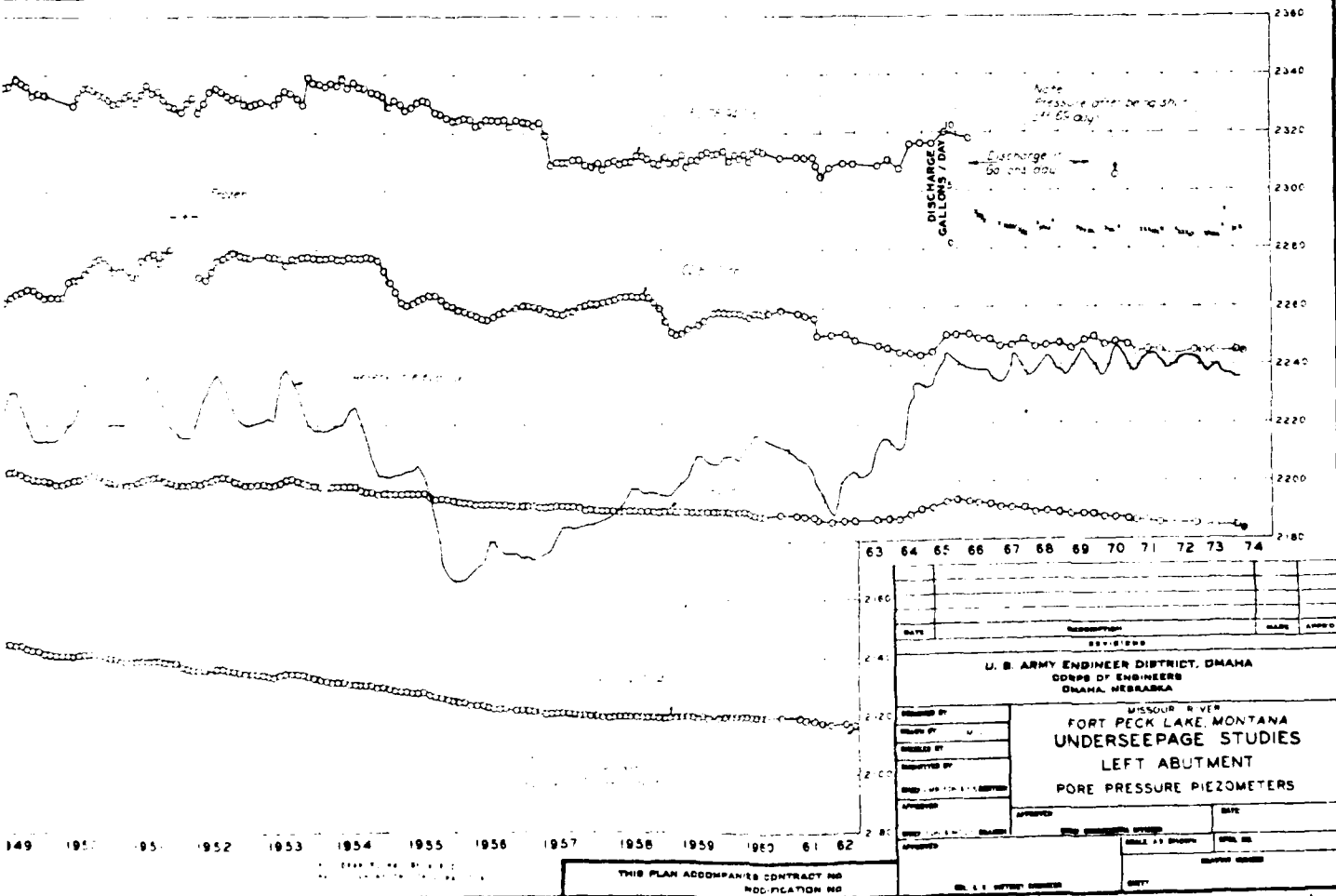
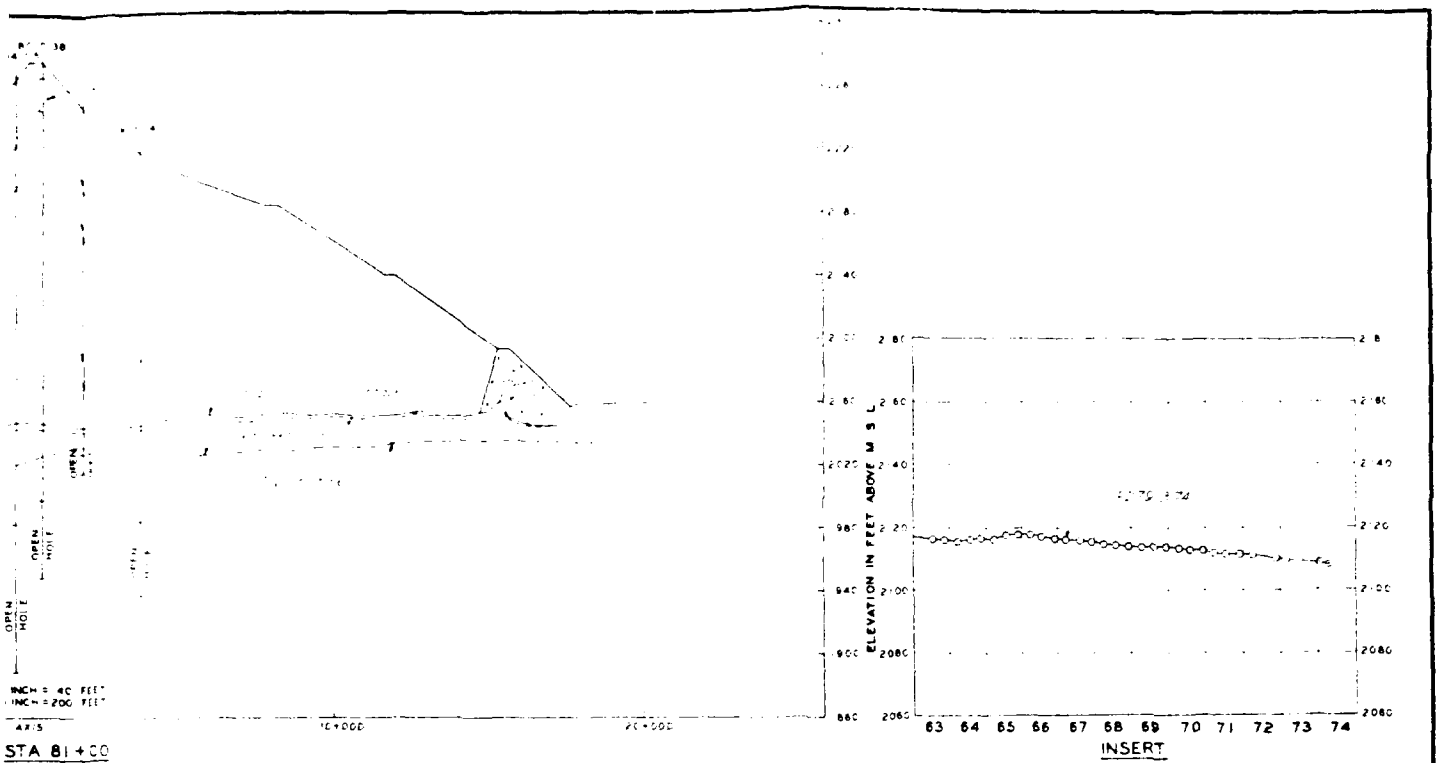
PLATE 41





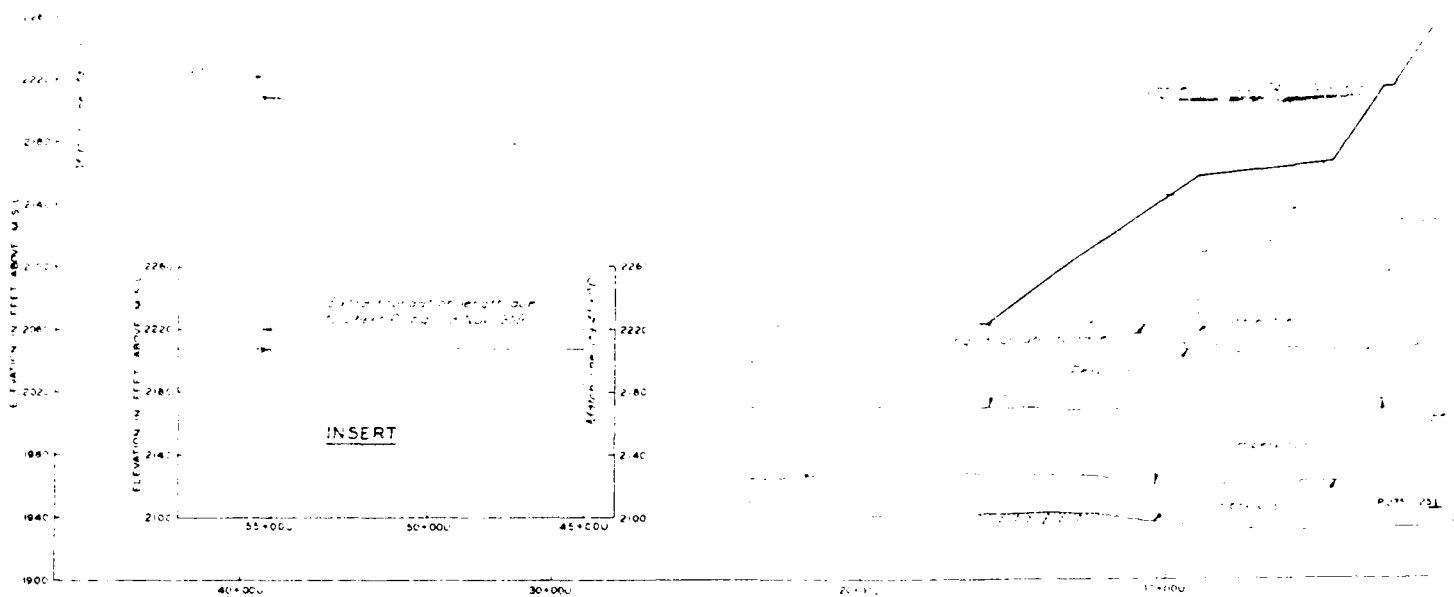
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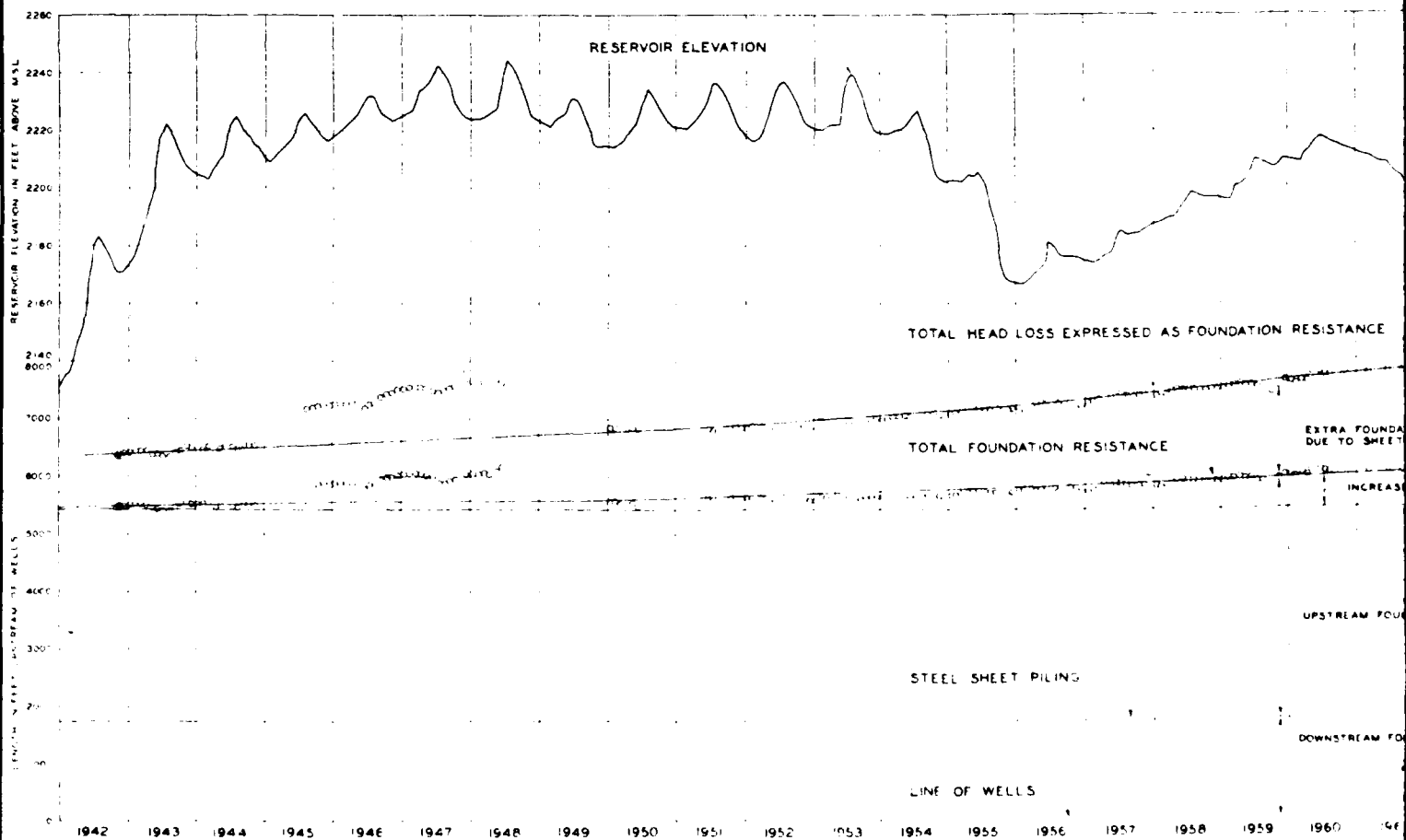
CONSTRUCTION FOUNDATION REPORT

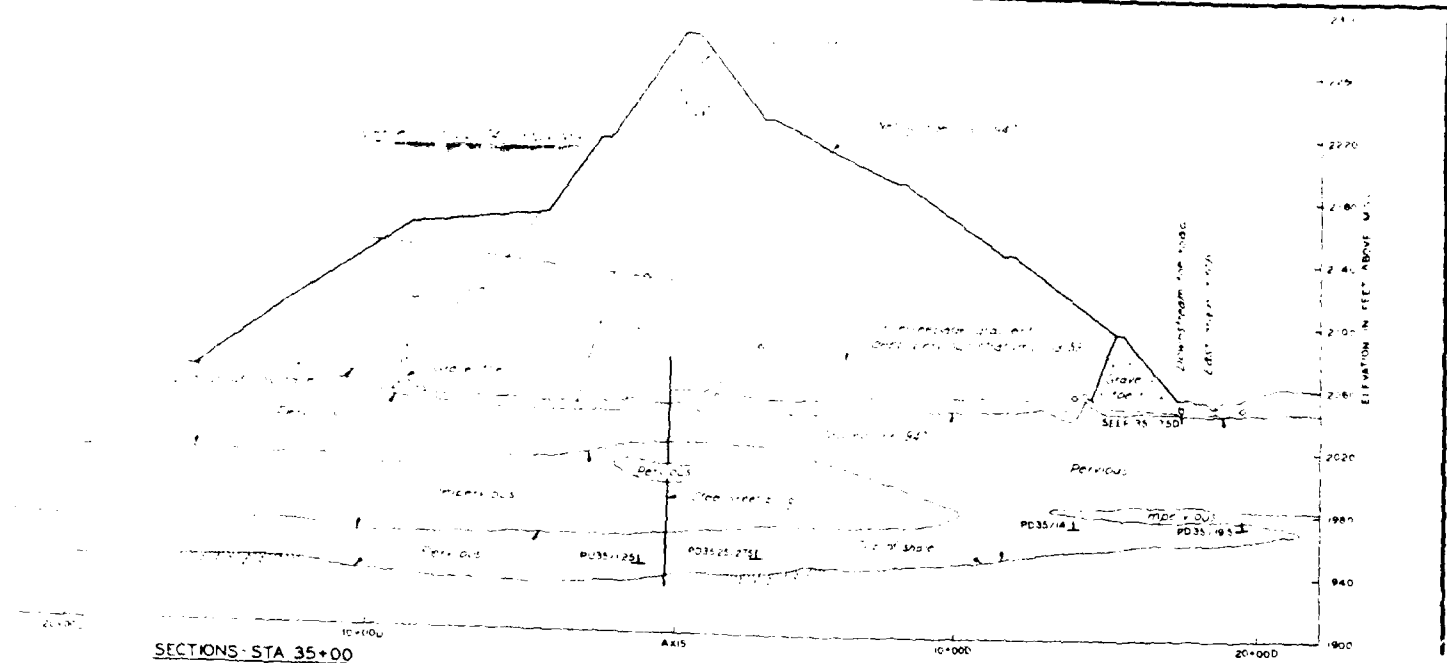
PLATE 43



SECTIONS - STA 35+00

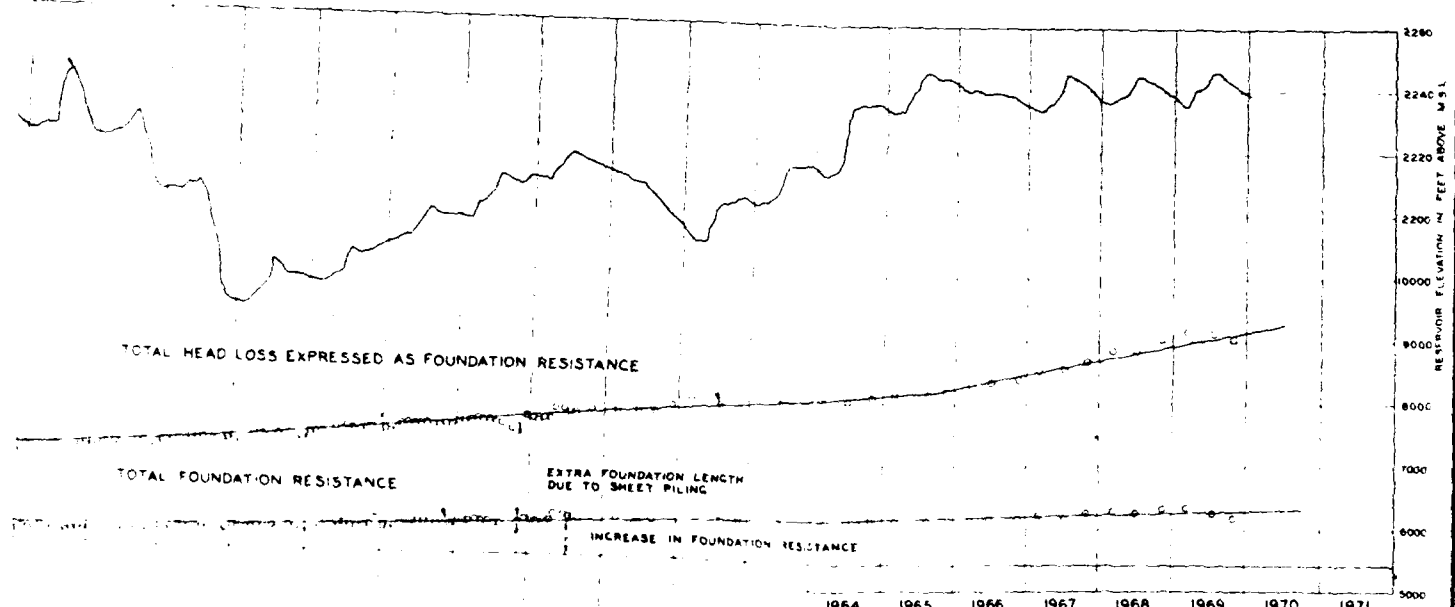
SCALE VERT. INCH = 4 FEET
HORIZ. INCH = 20 FEET





SECTIONS STA 35+00

VERT. INCH = 4 FEET
HORIZ. INCH = 200 FEET



TOTAL HEAD LOSS EXPRESSED AS FOUNDATION RESISTANCE

TOTAL FOUNDATION RESISTANCE

EXTRA FOUNDATION LENGTH DUE TO SHEET PILING

INCREASE IN FOUNDATION RESISTANCE

UPSTREAM FOUNDATION RESISTANCE

DOWNSTREAM FOUNDATION RESISTANCE

STEEL SHEET PILING

LINE OF WELLS

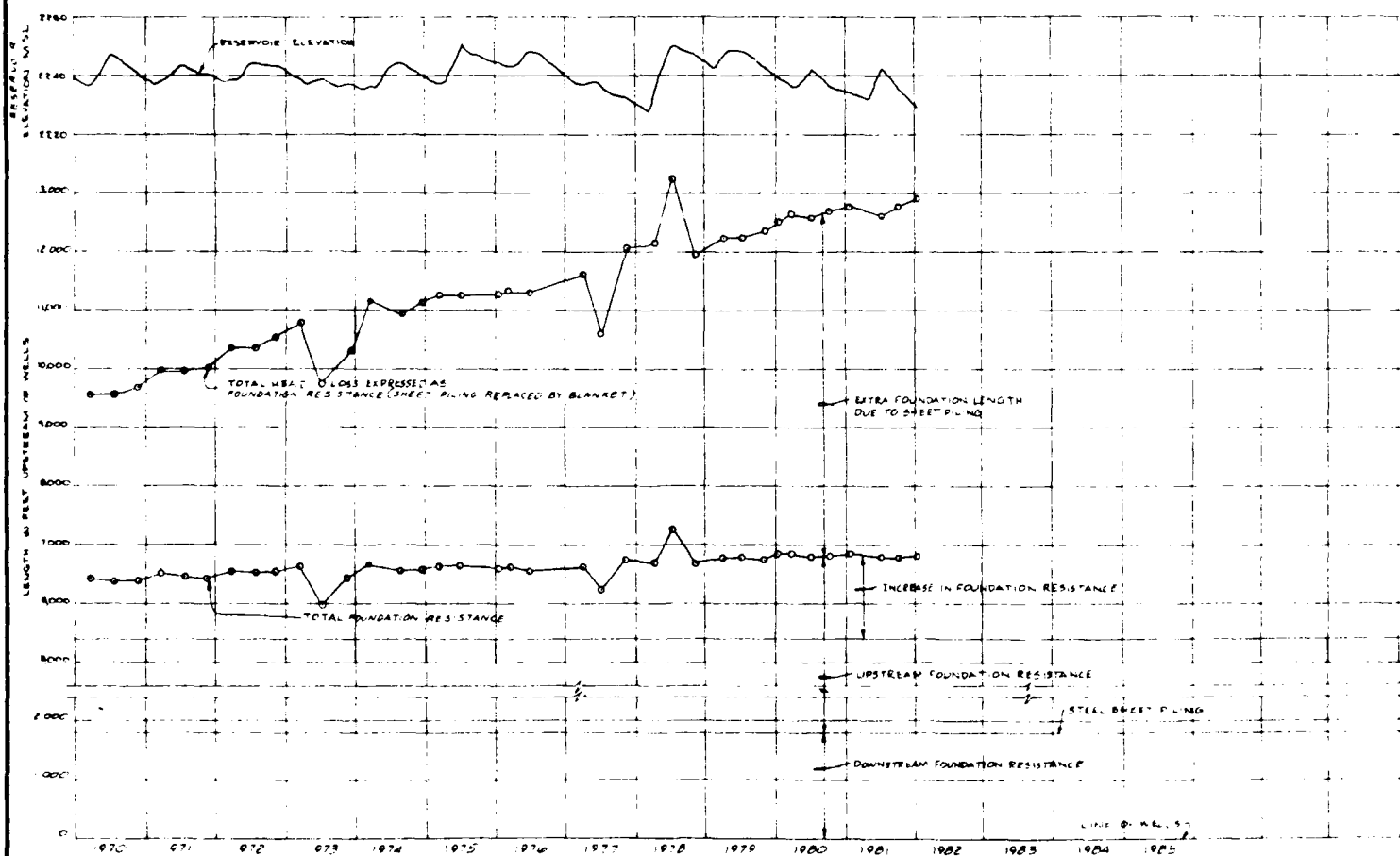
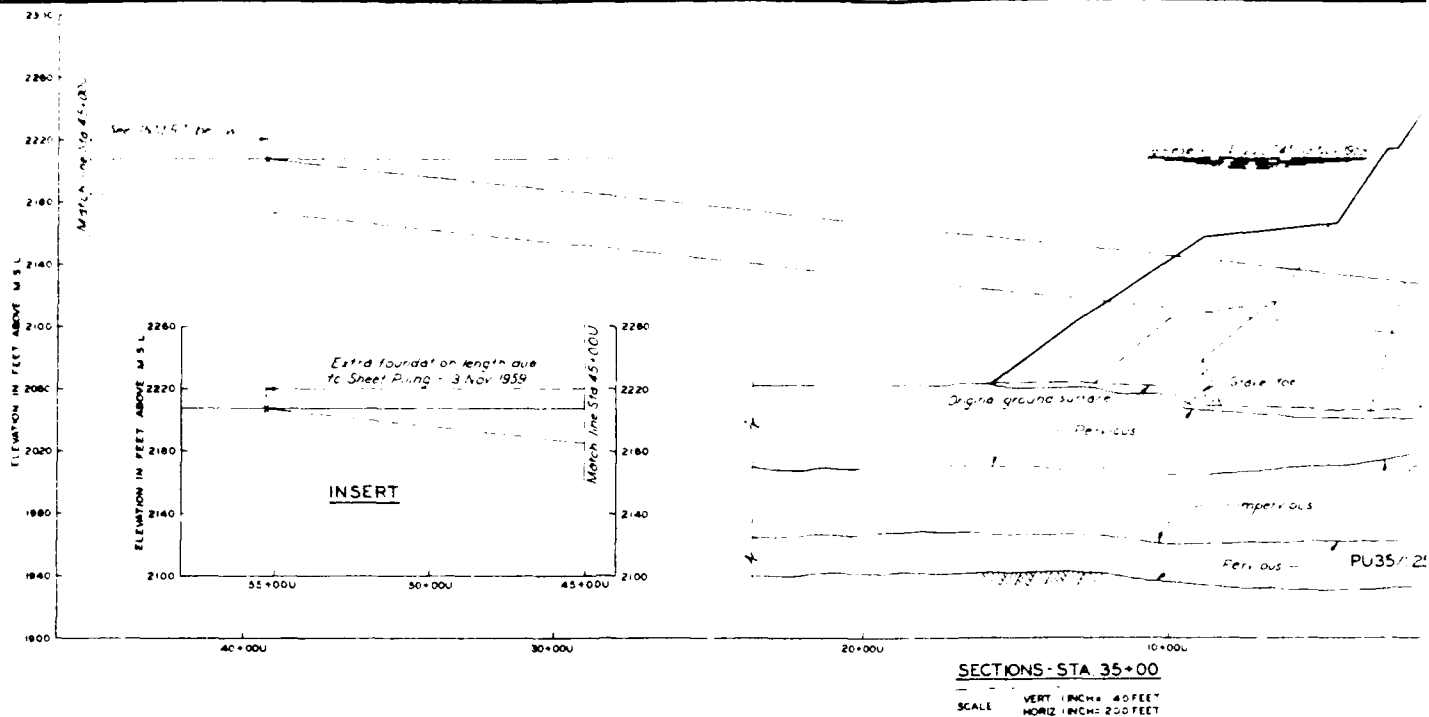
1953 1954 1955 1956 1957 1958 1959 1960 1961 1962 1963

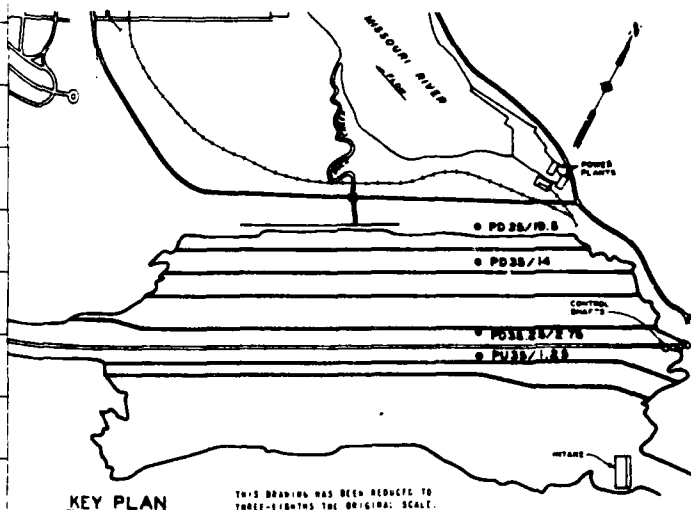
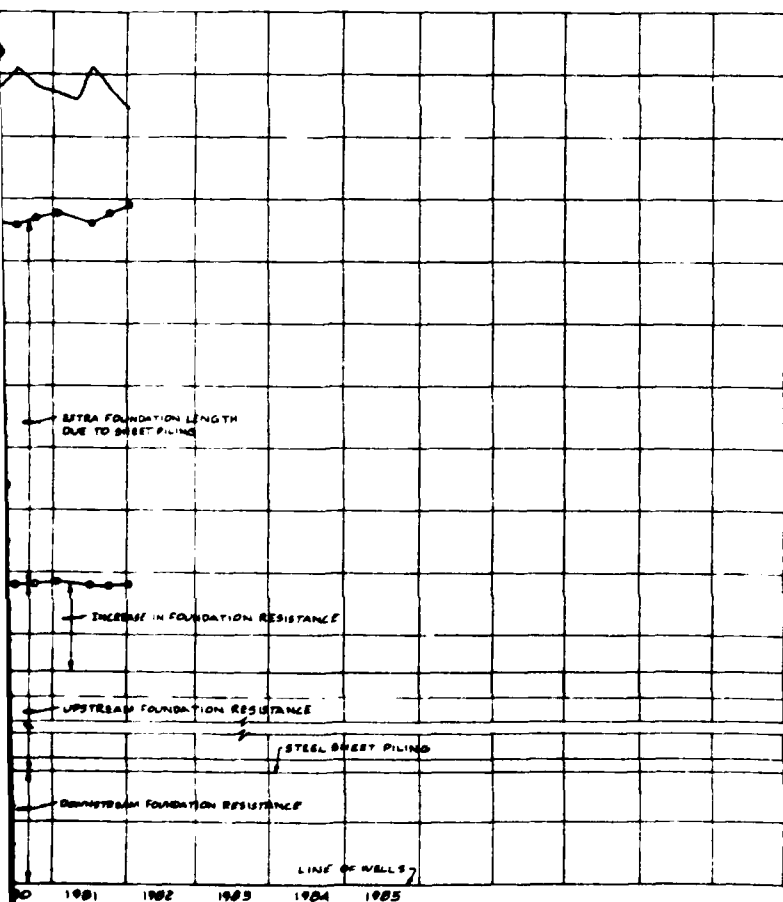
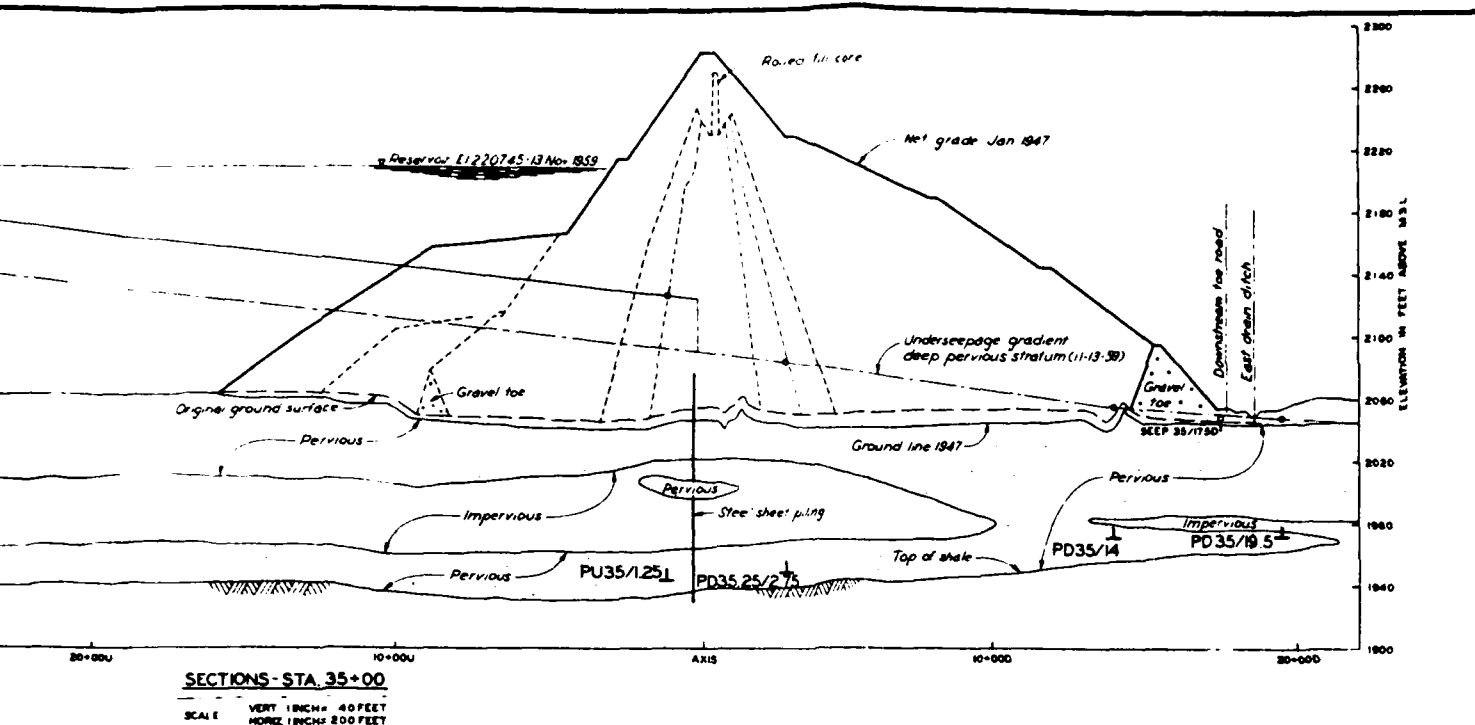


U.S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA	
FORT PECK LAKE, MONTANA UNDERSEEPAGE STUDIES STATION 35+00 ANALYSIS OF SEEPAGE PERFORMANCE	
DESIGNED BY	DATE
DRAWN BY	REVISION
CHECKED BY	DATE
APPROVED BY	DATE
THIS PLAN ACCOMPANIES CONTRACT NO. _____ MODIFICATION NO. _____	

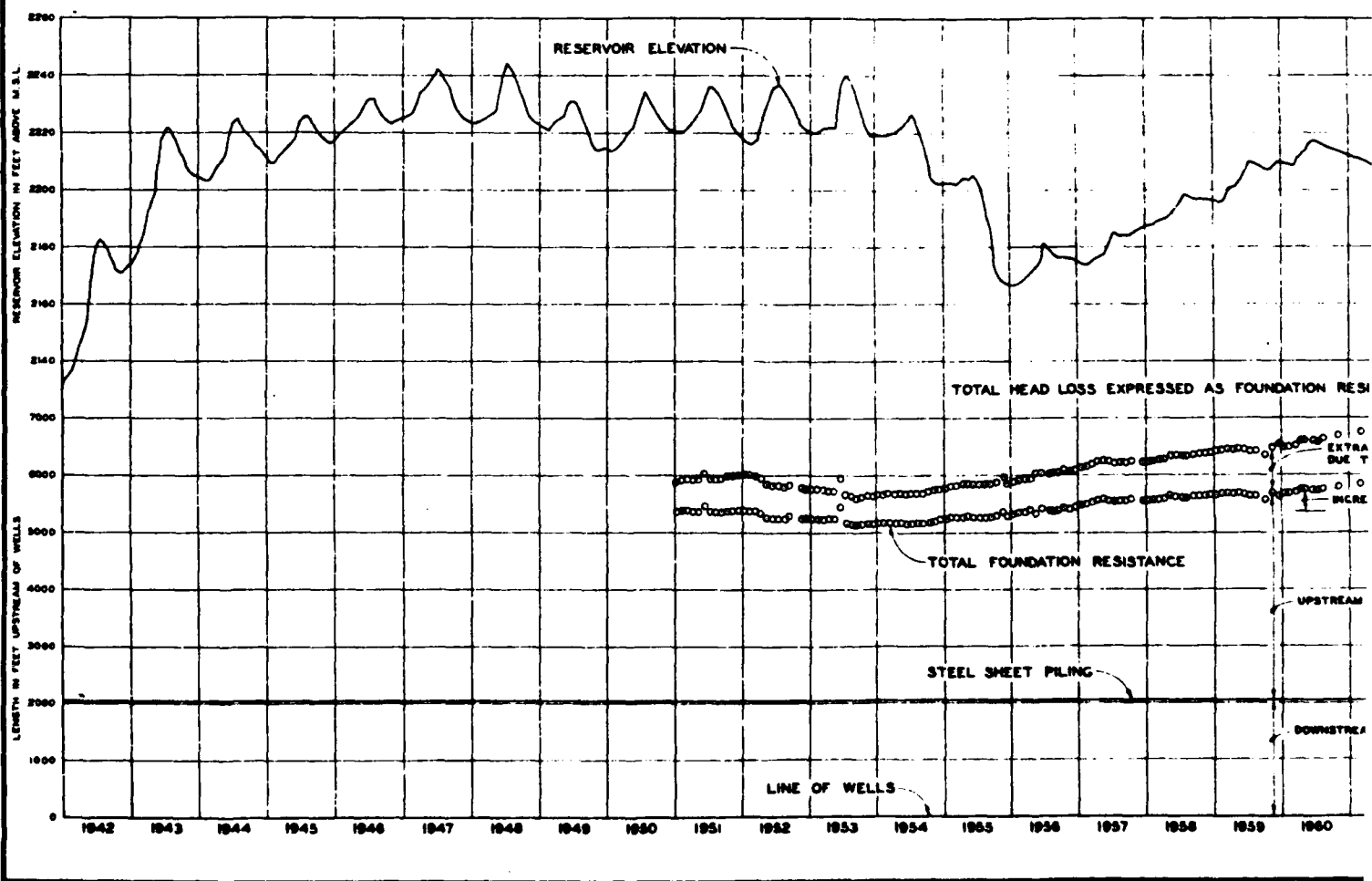
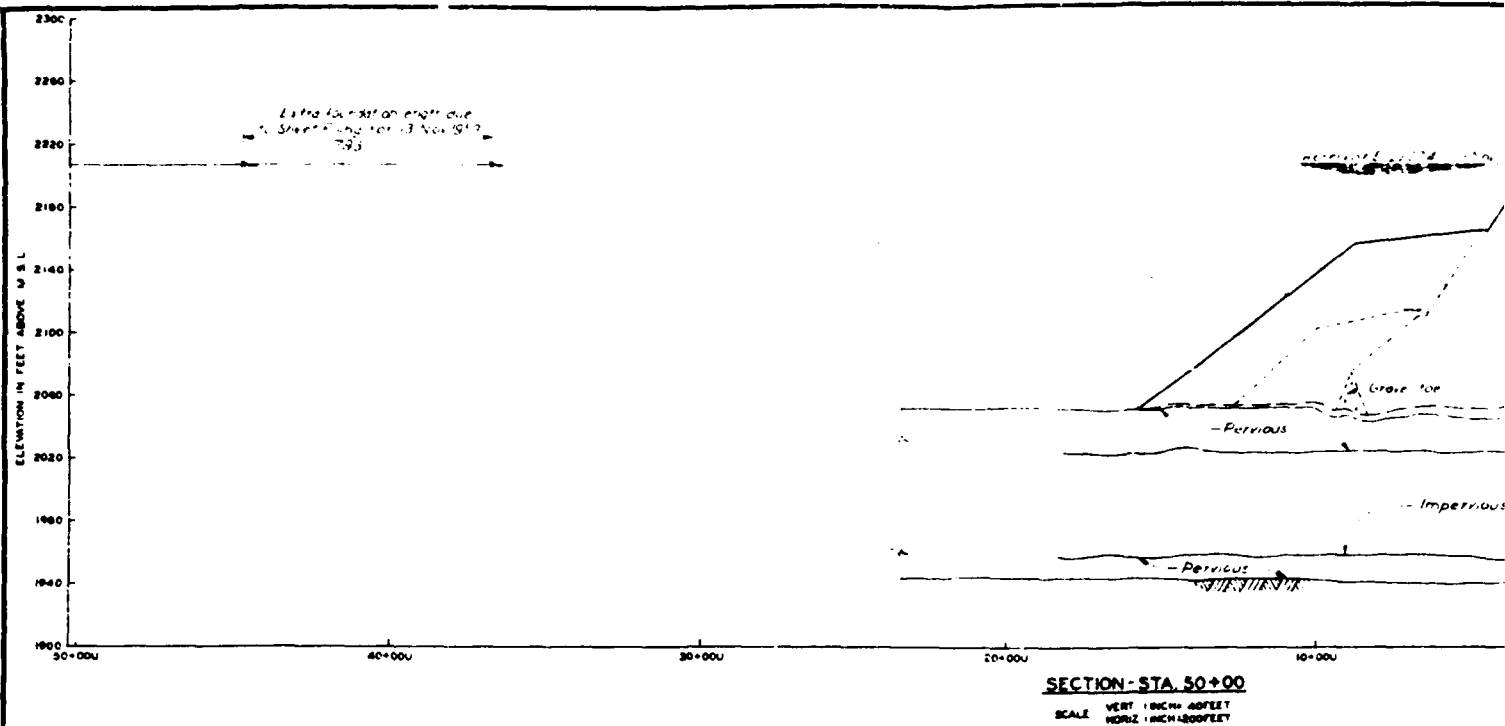
CONSTRUCTION FOUNDATION REPORT

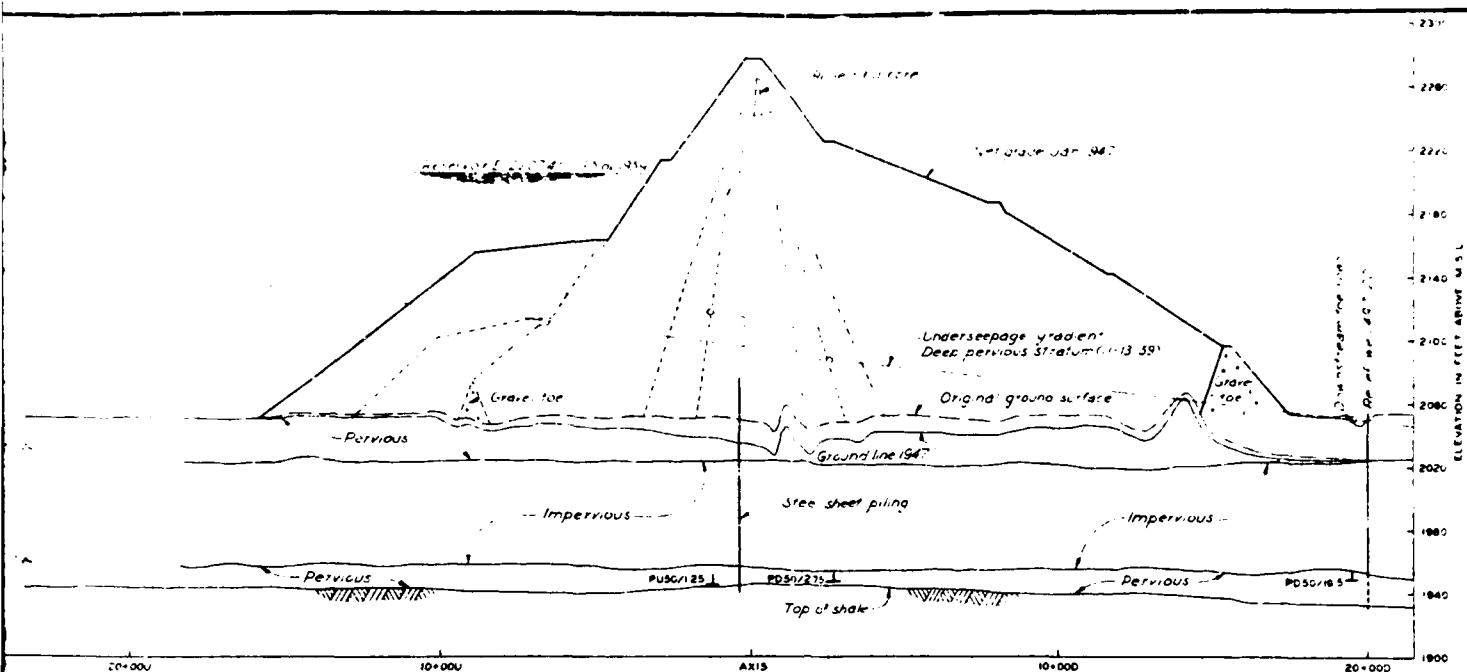
PLATE 44





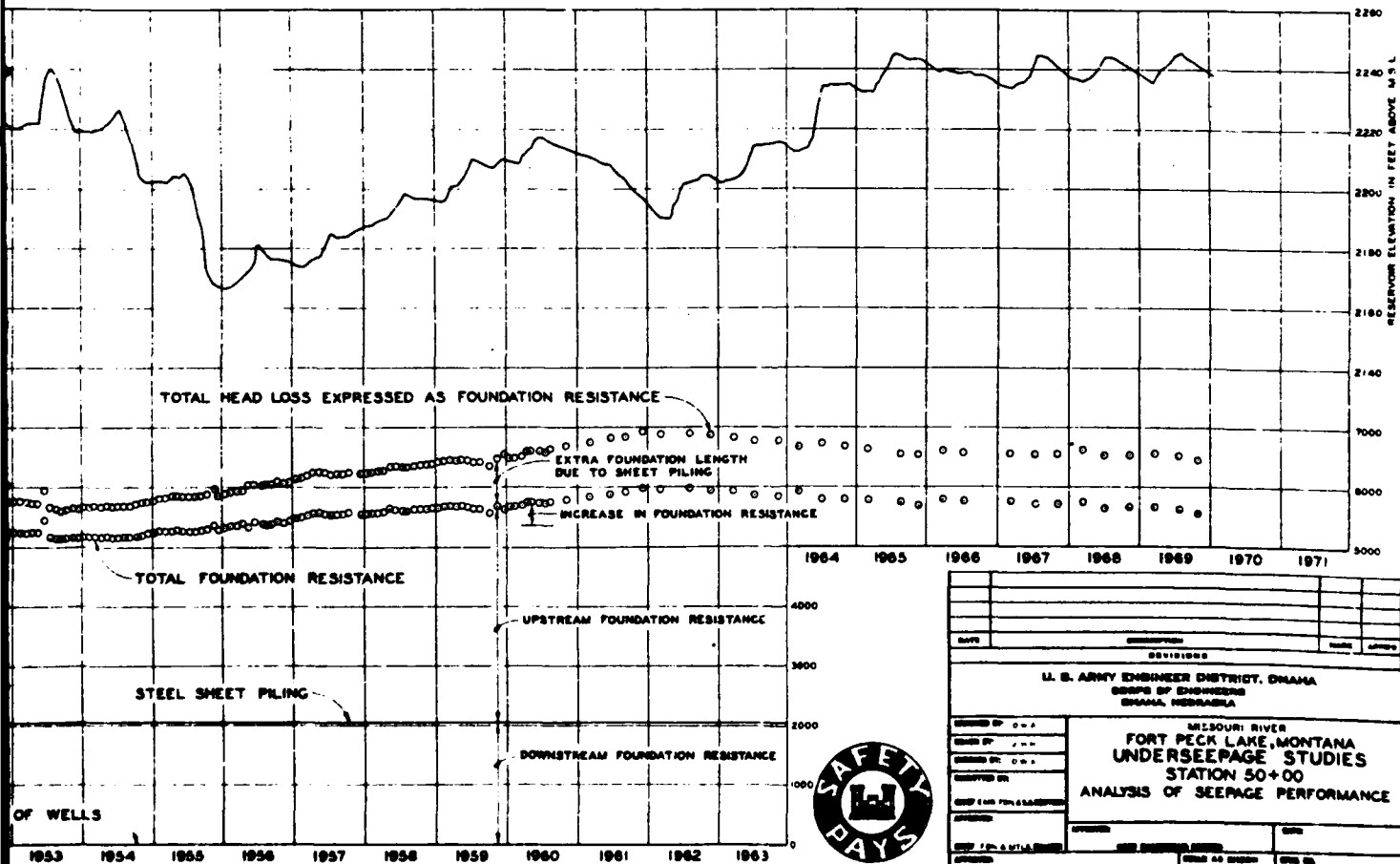
U. S. ARMY ENGINEER DISTRICT, OHAMA	
BRIGADE OF ENGINEERS OHAMA, NEBRASKA	
MISSOURI RIVER FORT PECK LAKE, MONTANA UNDERSEepage STUDIES STATION 35+00 ANALYSIS OF SEEPAGE PERFORMANCE BENEATH CLAY STRATUM	
DESIGNED BY	DATE
CHECKED BY	DATE
APPROVED BY	DATE
PROJECT	DATE
REVISION NO.	DATE
REVISION NO.	DATE
REVISION NO.	DATE





SECTION - STA. 50+00

VERT 1 INCH = 40 FEET
SCALE
HORIZ 1 INCH = 200 FEET

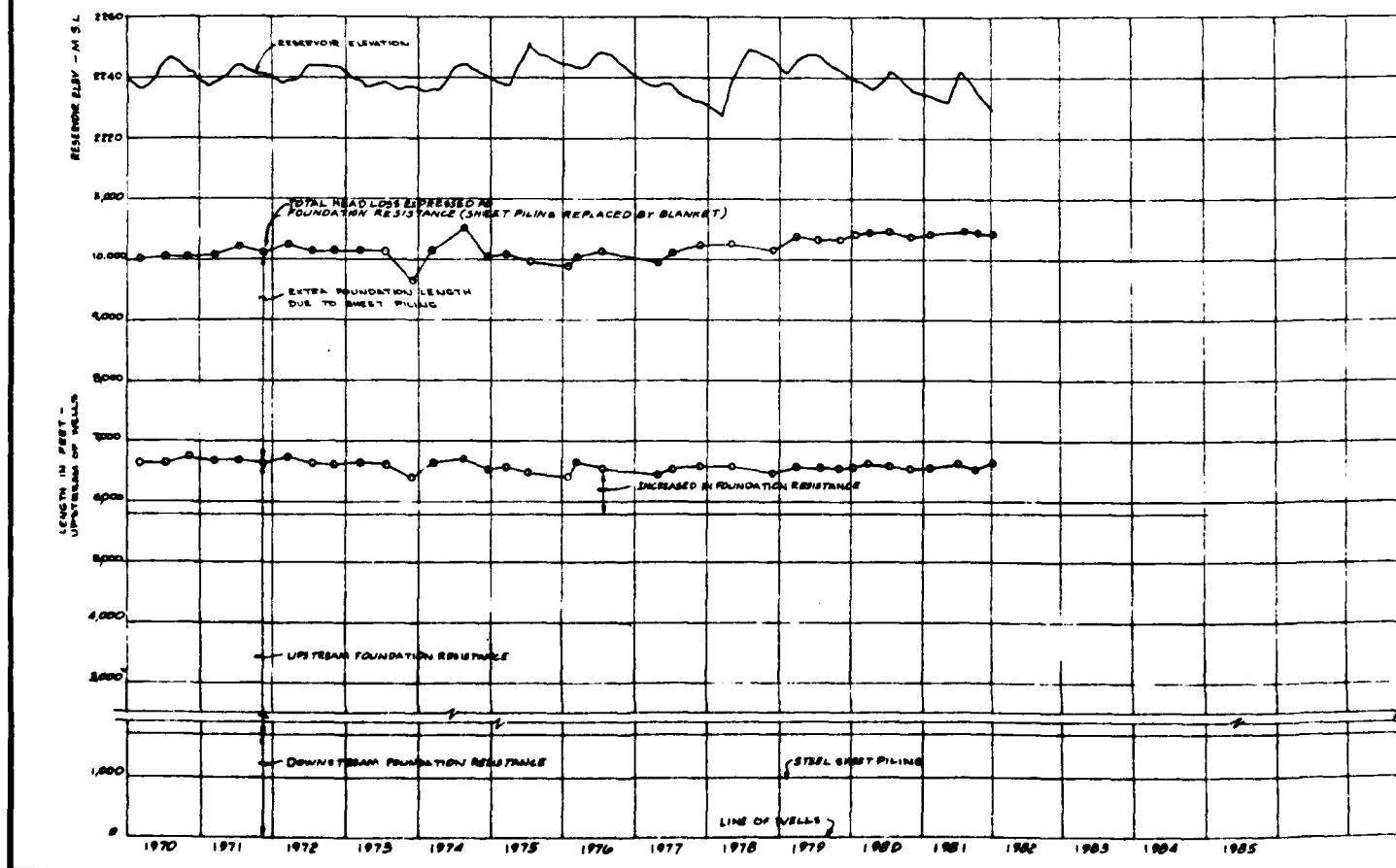
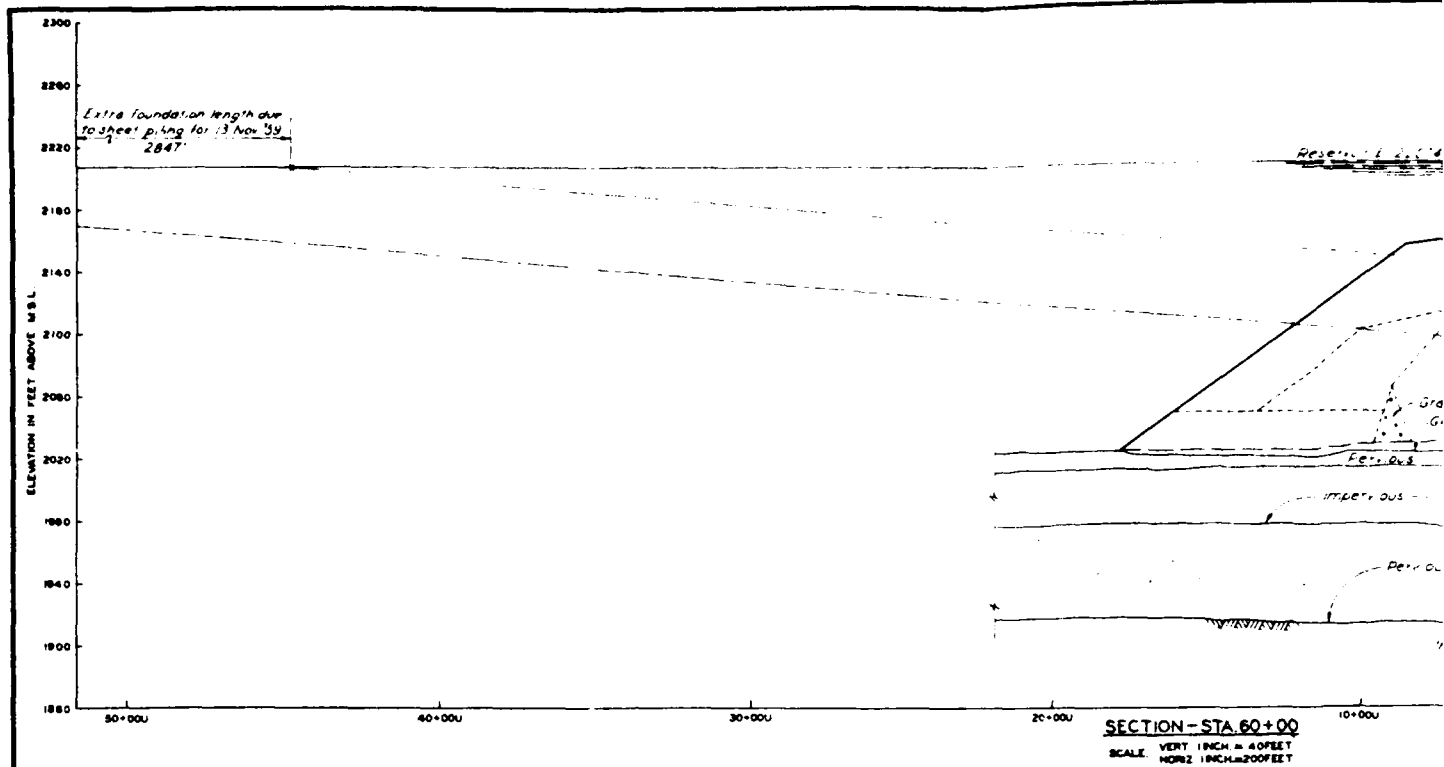


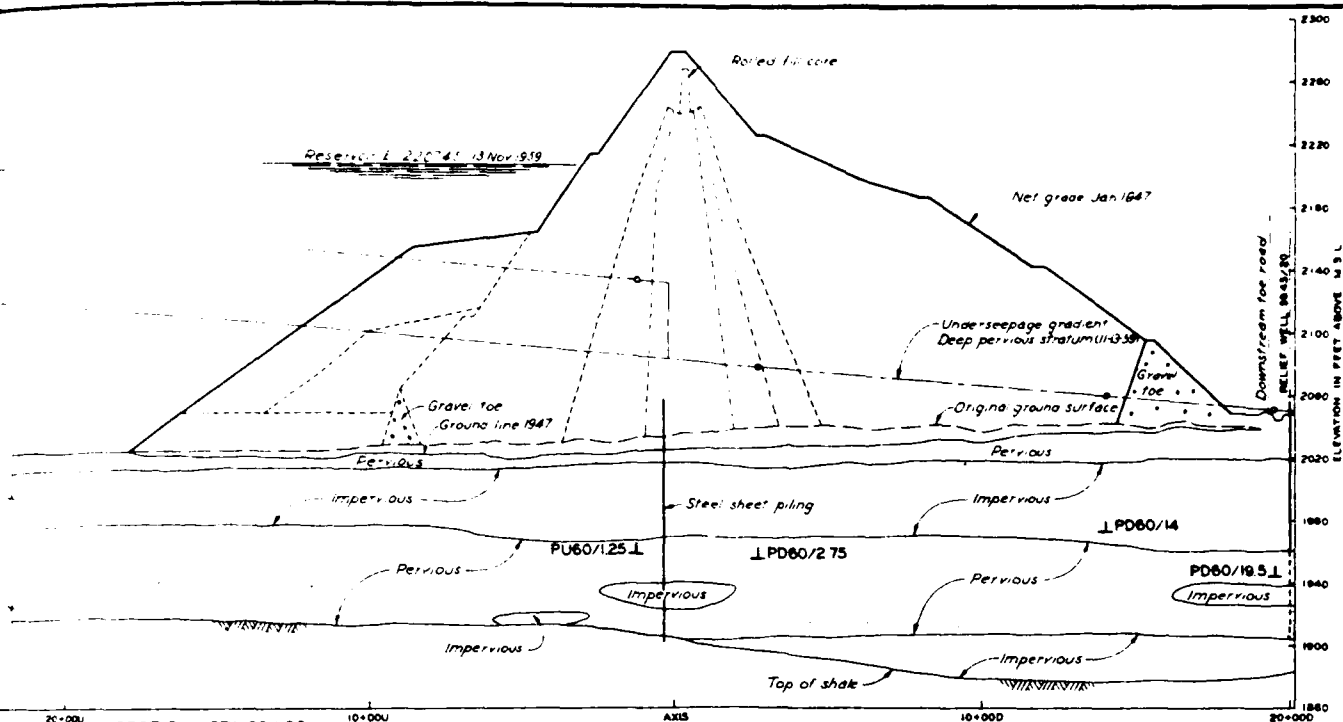
U. S. ARMY ENGINEER DISTRICT, DHAHA GROUP OF ENGINEERS DHAHA, NEBRASKA	
MISSOURI RIVER FORT PECK LAKE, MONTANA UNDERSEEPAGE STUDIES STATION 50+00 ANALYSIS OF SEEPAGE PERFORMANCE	
DESIGNED BY: C. A. A.	DATE: 10/1/63
DRAWN BY: J. A. A.	DATE: 10/1/63
CHECKED BY: C. A. A.	DATE: 10/1/63
APP. 1: J. A. A. & M. A. A.	DATE: 10/1/63
APP. 2: J. A. A. & M. A. A.	DATE: 10/1/63
APP. 3: J. A. A. & M. A. A.	DATE: 10/1/63
APP. 4: J. A. A. & M. A. A.	DATE: 10/1/63
APP. 5: J. A. A. & M. A. A.	DATE: 10/1/63
APP. 6: J. A. A. & M. A. A.	DATE: 10/1/63
APP. 7: J. A. A. & M. A. A.	DATE: 10/1/63
APP. 8: J. A. A. & M. A. A.	DATE: 10/1/63
APP. 9: J. A. A. & M. A. A.	DATE: 10/1/63
APP. 10: J. A. A. & M. A. A.	DATE: 10/1/63

CONSTRUCTION FOUNDATION REPORT

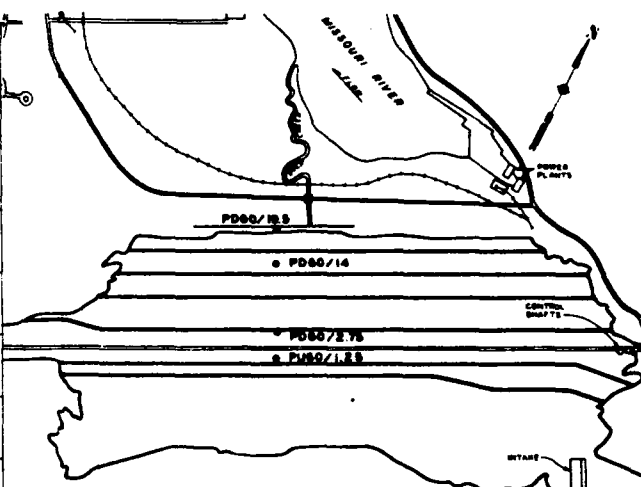
PLATE 46

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SECTION - STA. 60+00
VERT. 1 INCH = 40 FEET
HORIZ. 1 INCH = 200 FEET



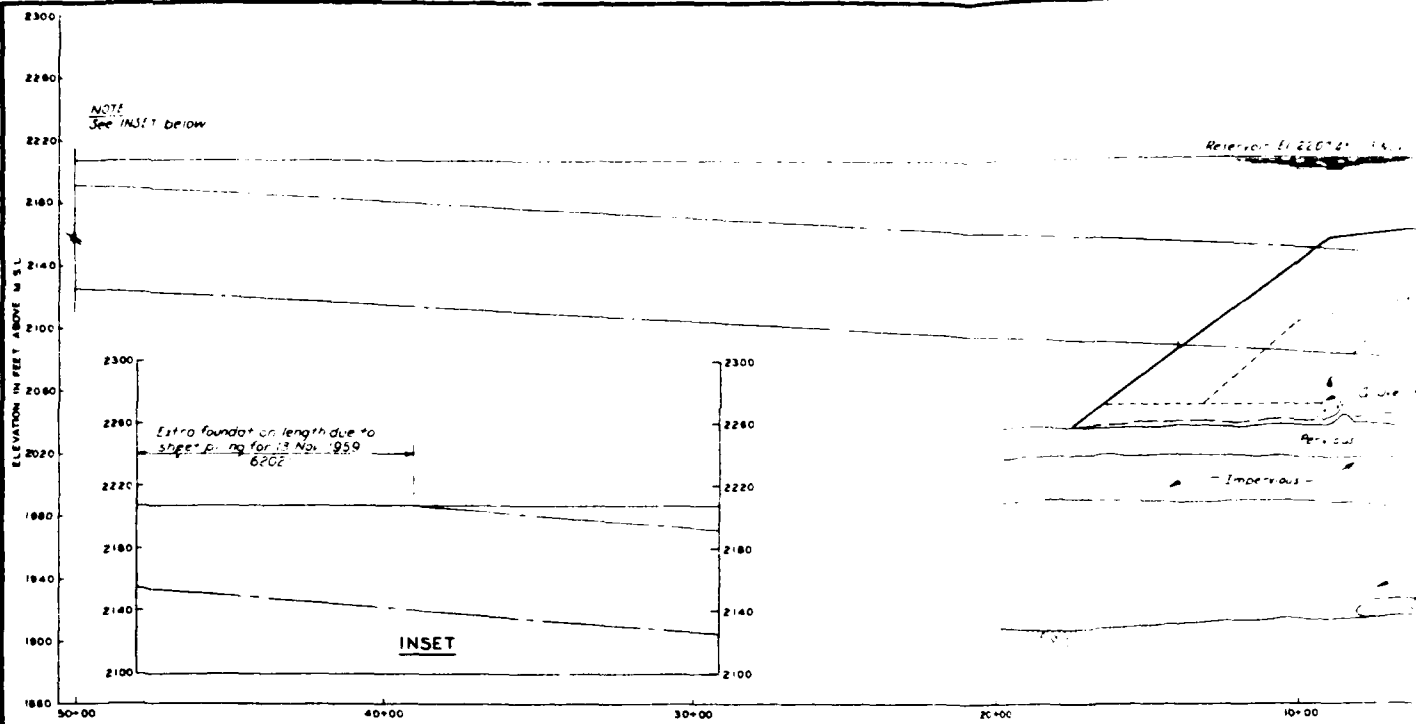
KEY PLAN

THIS DRAWING HAS BEEN REDUCED TO
THREE-FOURTHS THE ORIGINAL SCALE.

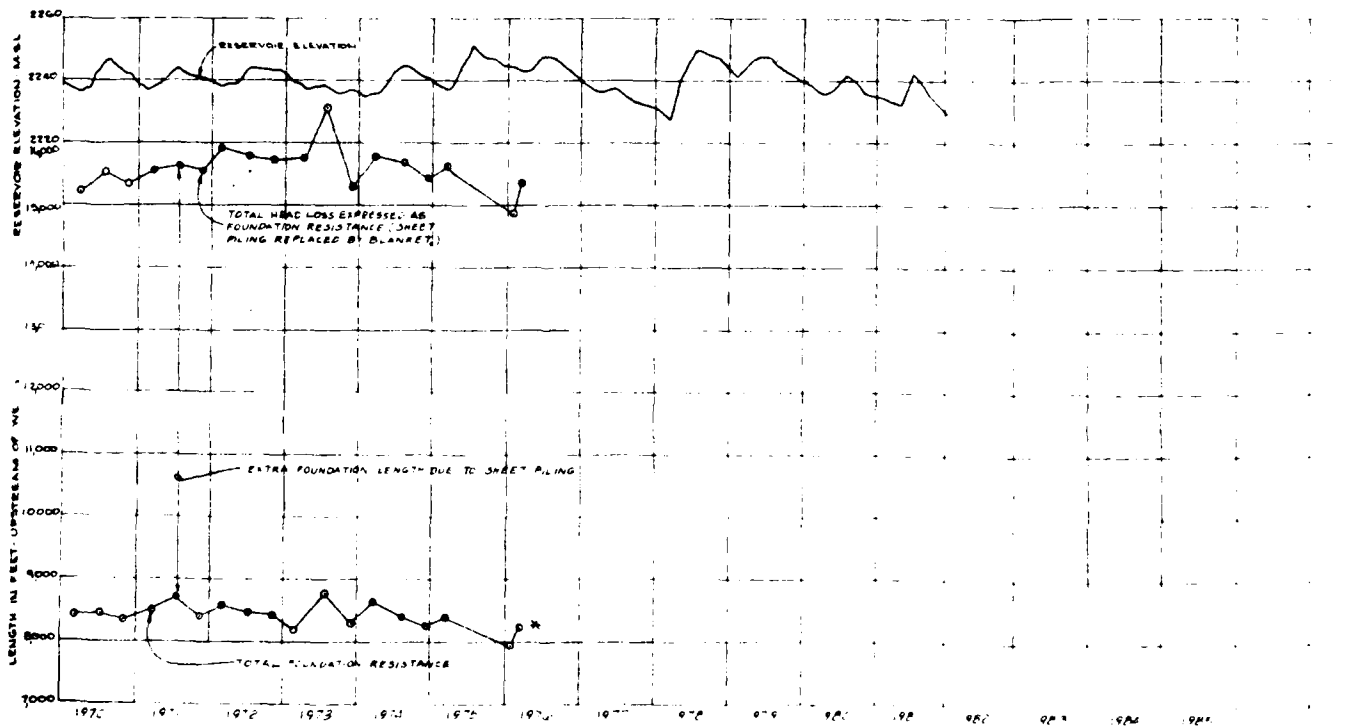
DATE	DESCRIPTION	DATE	APPROVED
REVISIONS			
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA			
MISSOURI RIVER FORT PECK LAKE, MONTANA UNDERSEEPAGE STUDIES STATION 60+00 ANALYSIS OF SEEPAGE PERFORMANCE BENEATH CLAY STRATUM			
DESIGNED BY	CHECKED BY	APPROVED BY	DATE
DRAWN BY	CHECKED BY	APPROVED BY	DATE
SCALE	DATE	DATE	DATE
DATE	DATE	DATE	DATE



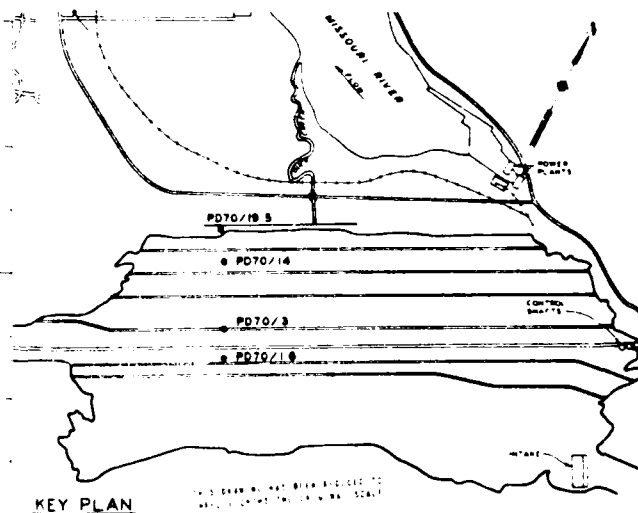
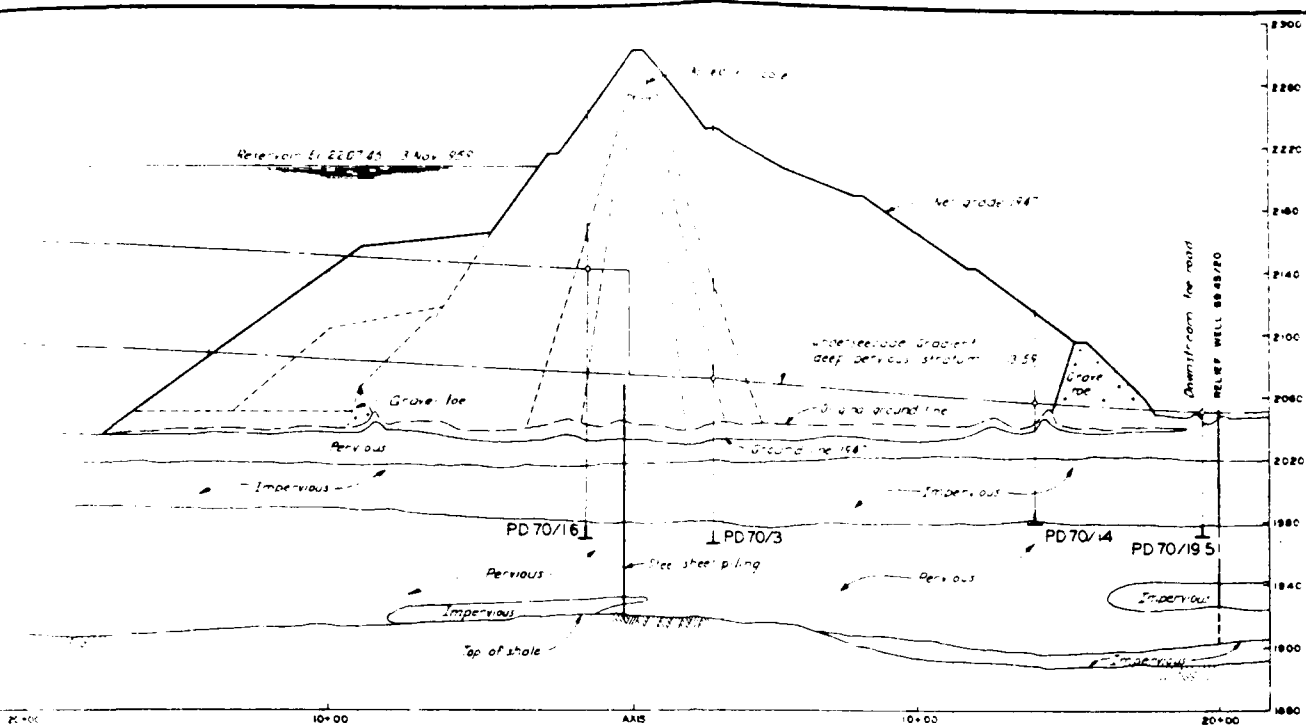
THIS PLAN ACCOMPANIES CONTRACT NO. _____
MODIFICATION NO. _____



SECTION - STA 70+00
SCALE VERT 1 INCH = 40 FEET
HORIZ 1 INCH = 200 FEET

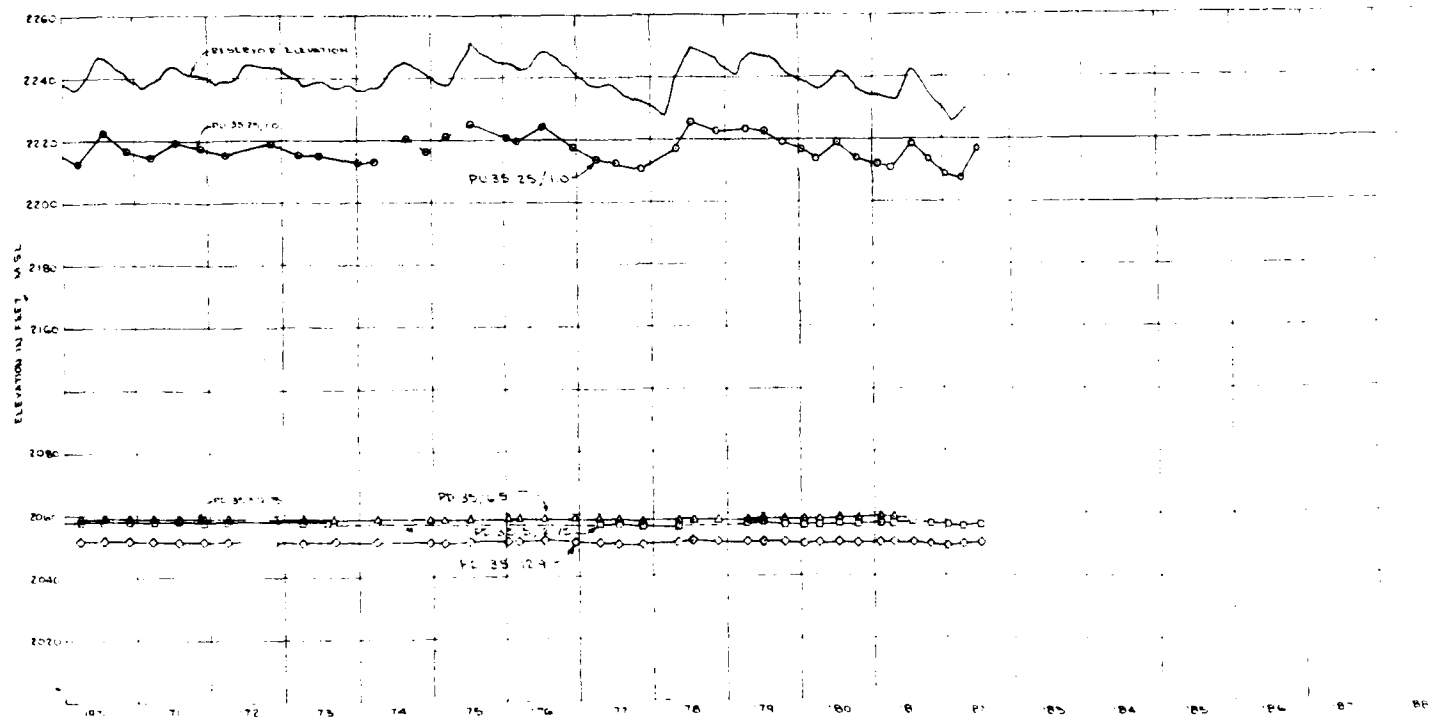
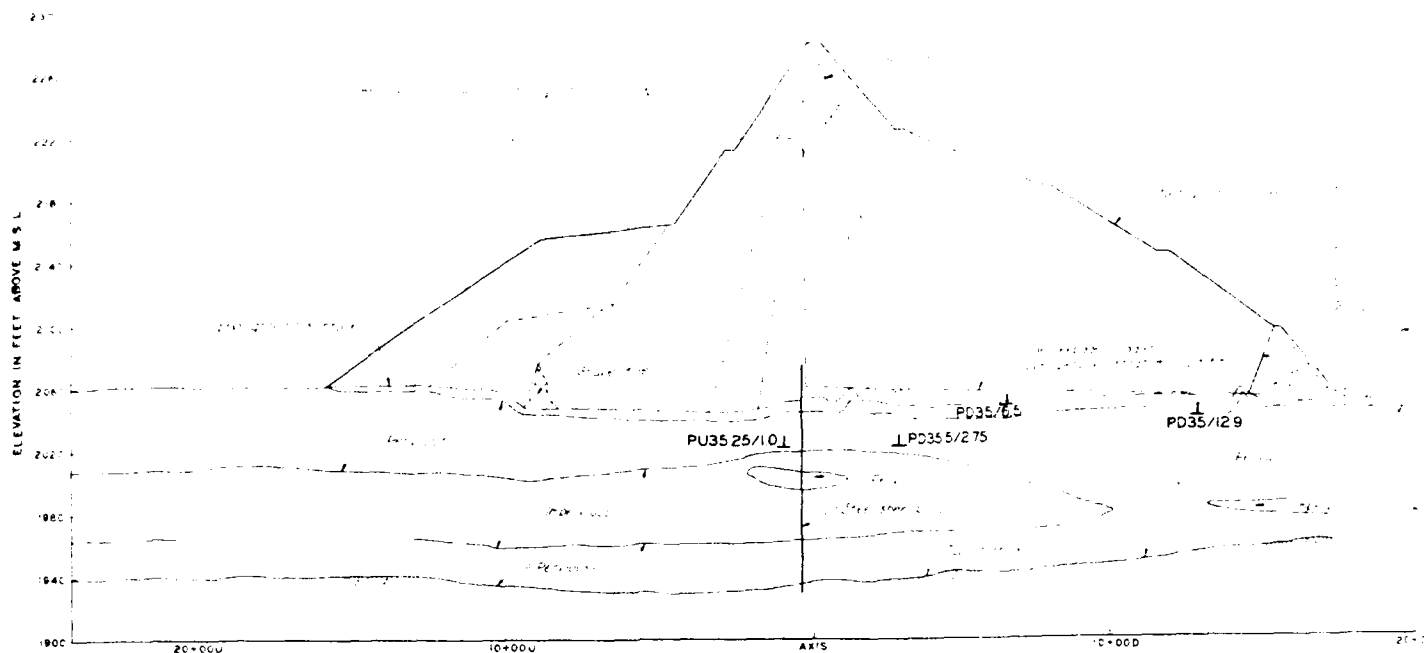


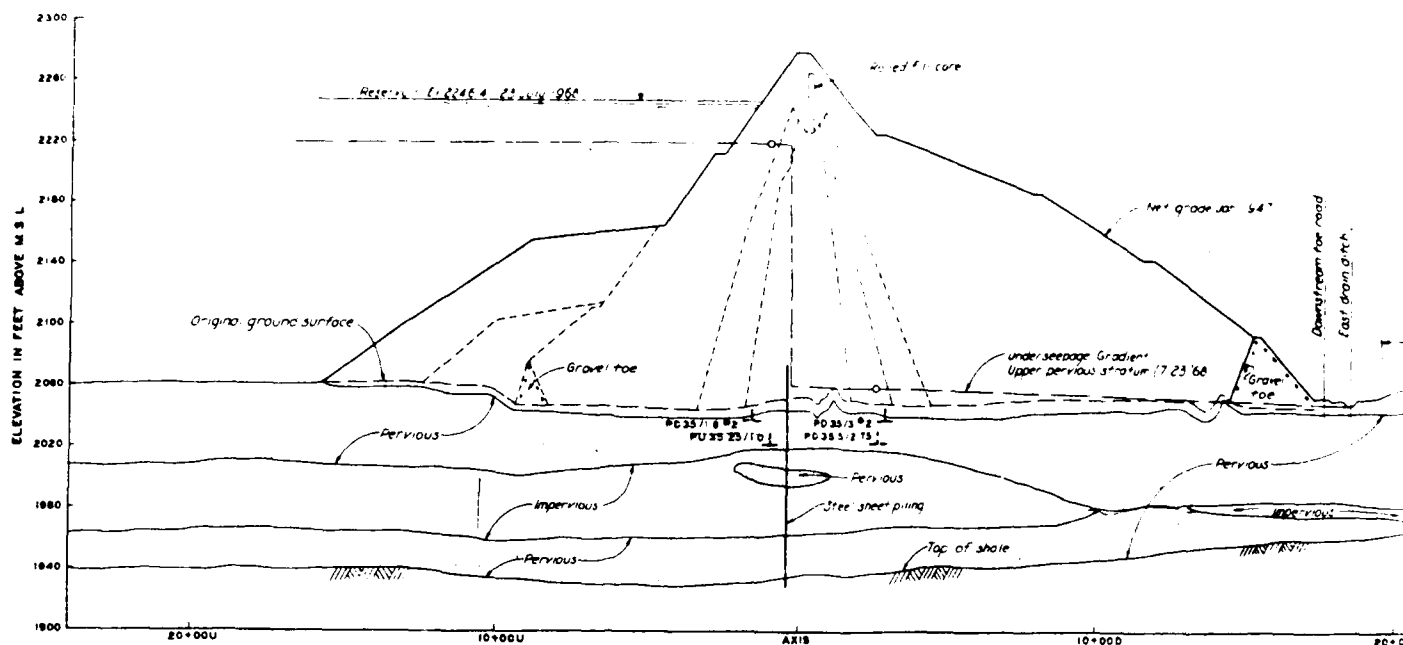
P1 70/16 under water since 1976



DATE		CLASSIFICATION		GRADE		APPROVED	
REVISOR'S							
U. S. ARMY ENGINEER DISTRICT, OMAHA BODIES OF ENGINEERS OMAHA, NEBRASKA							
DESIGNED BY		MISSOURI RIVER		FORT PECK LAKE MONTANA UNDERSEEPAGE STUDIES STATION 70+00 ANALYSIS OF SEEPAGE PERFORMANCE BENEATH CLAY STRATUM			
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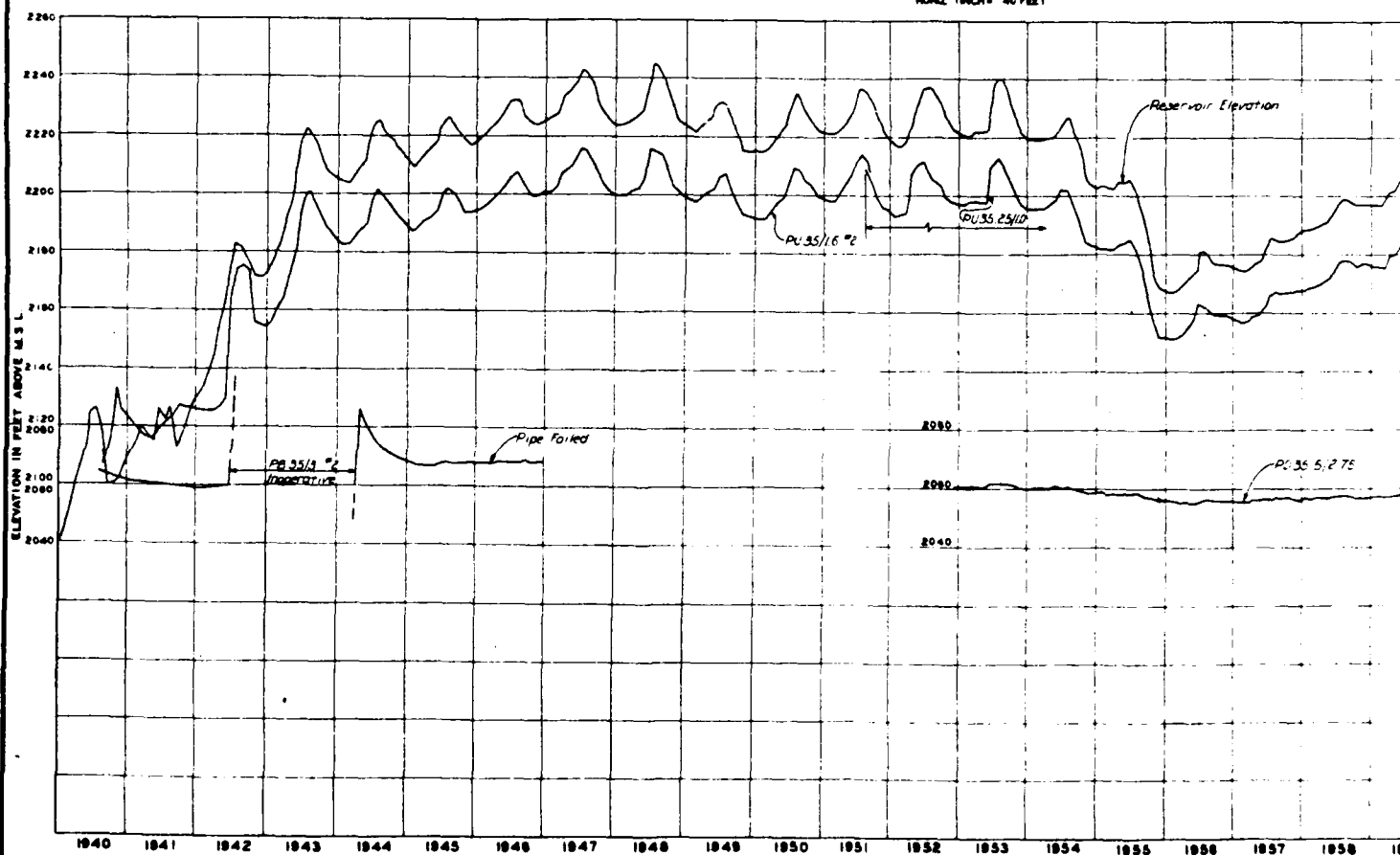


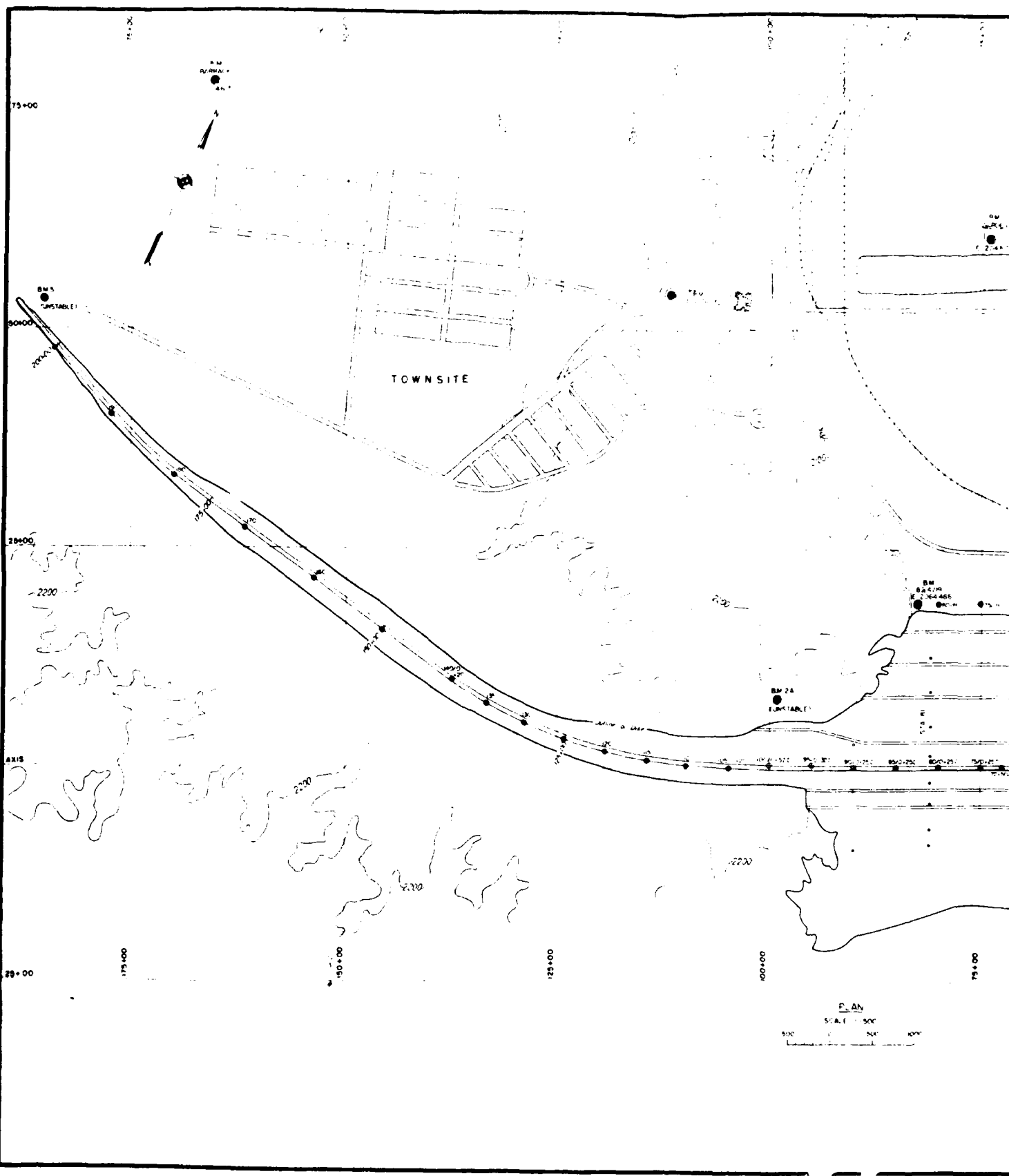




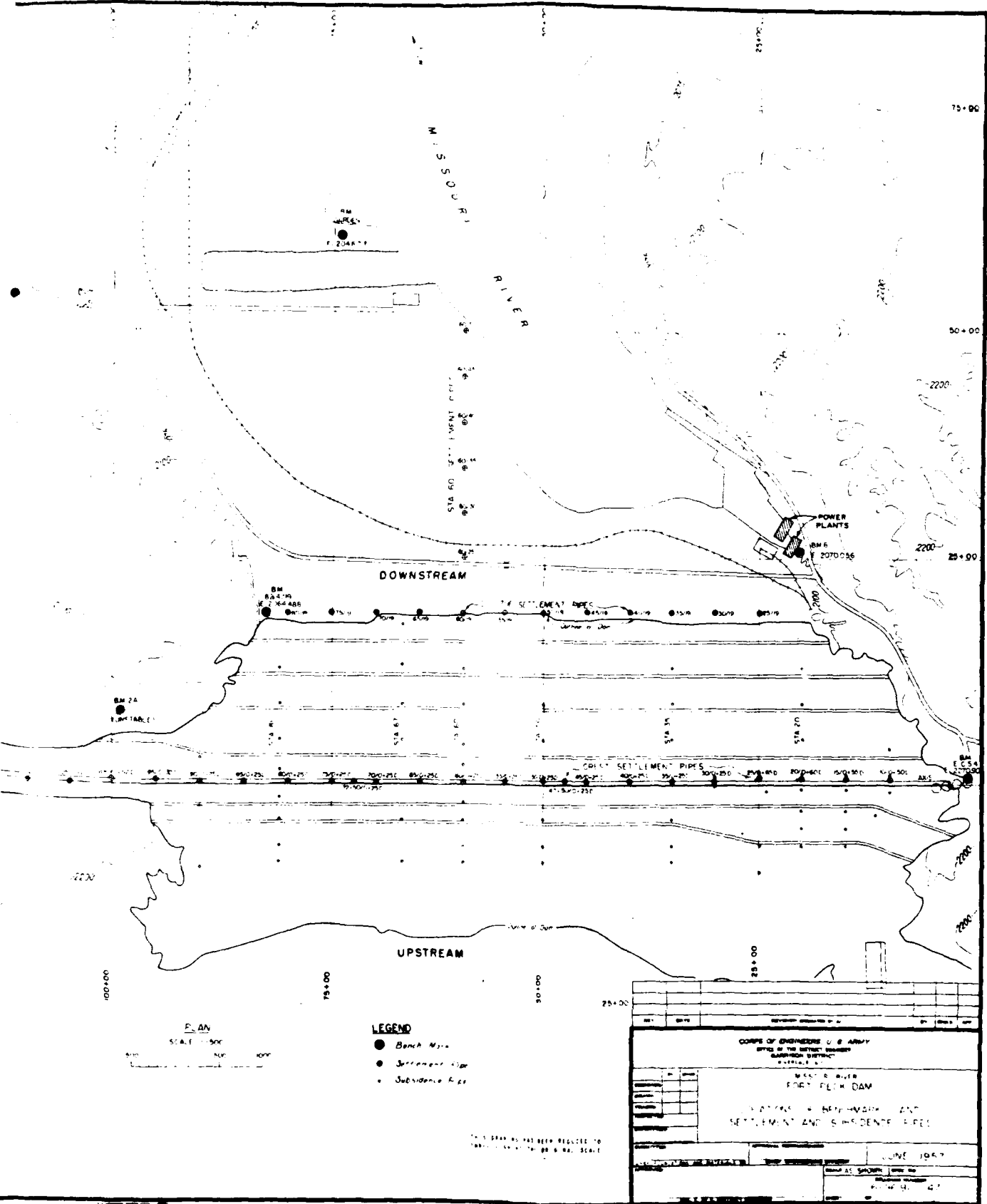
SECTION - STA. 35+00

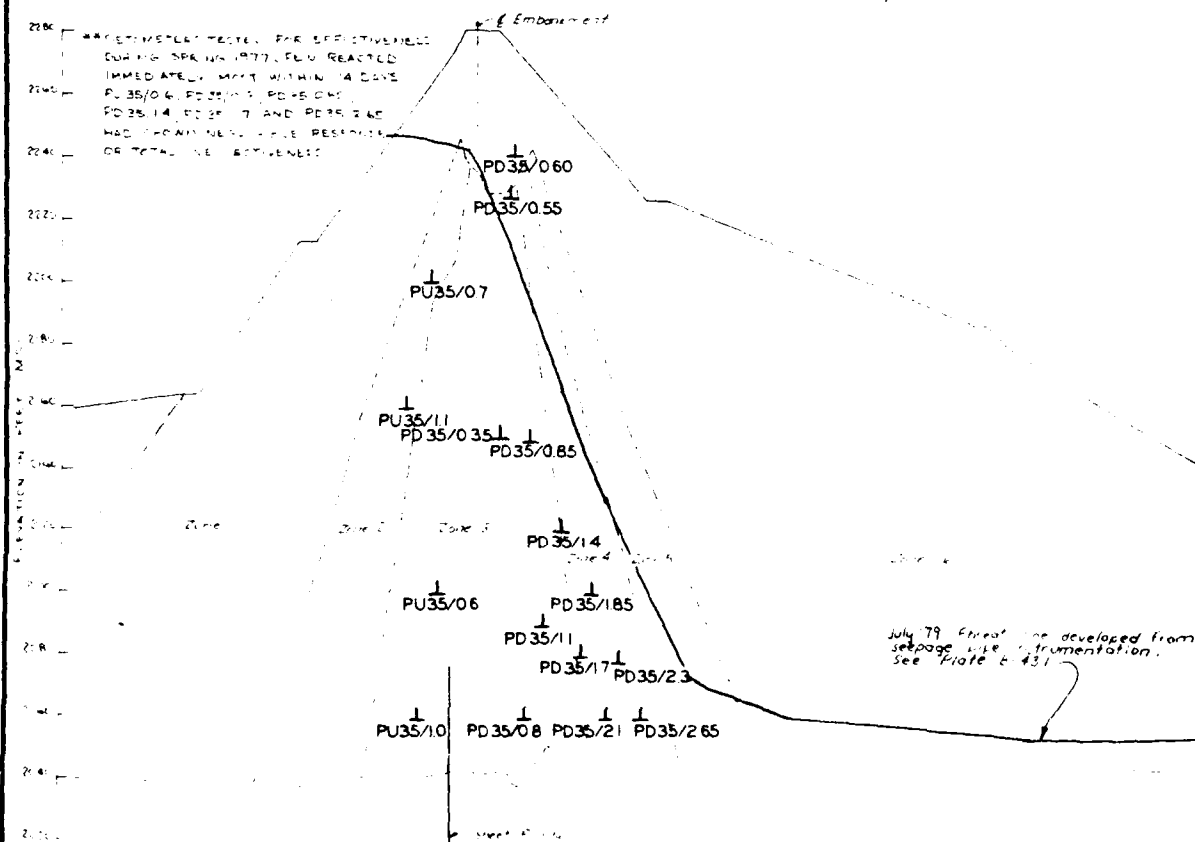
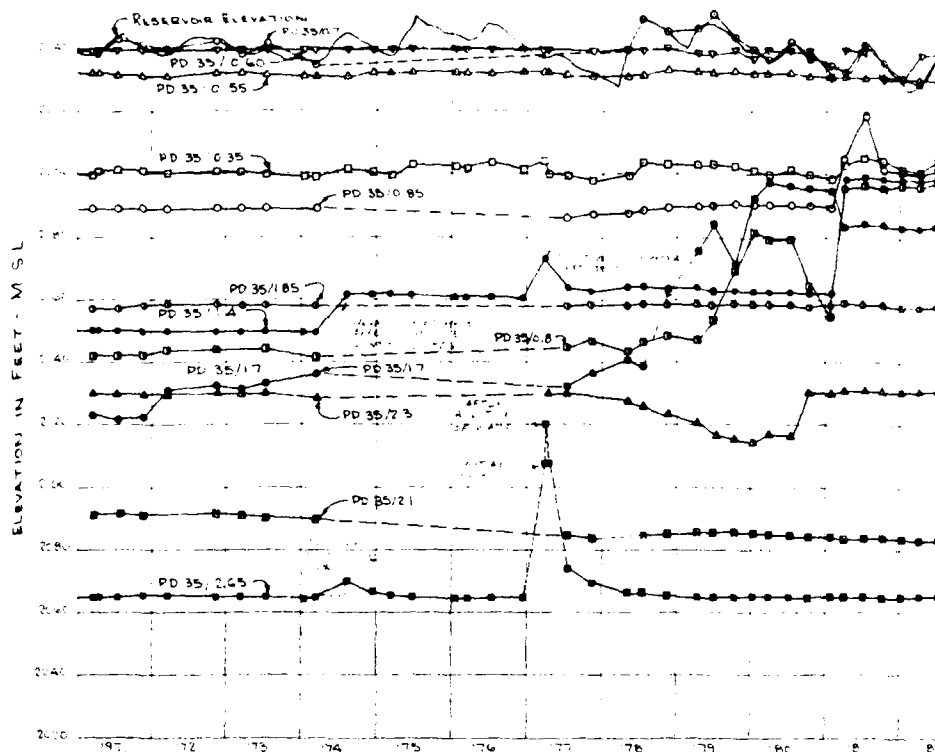
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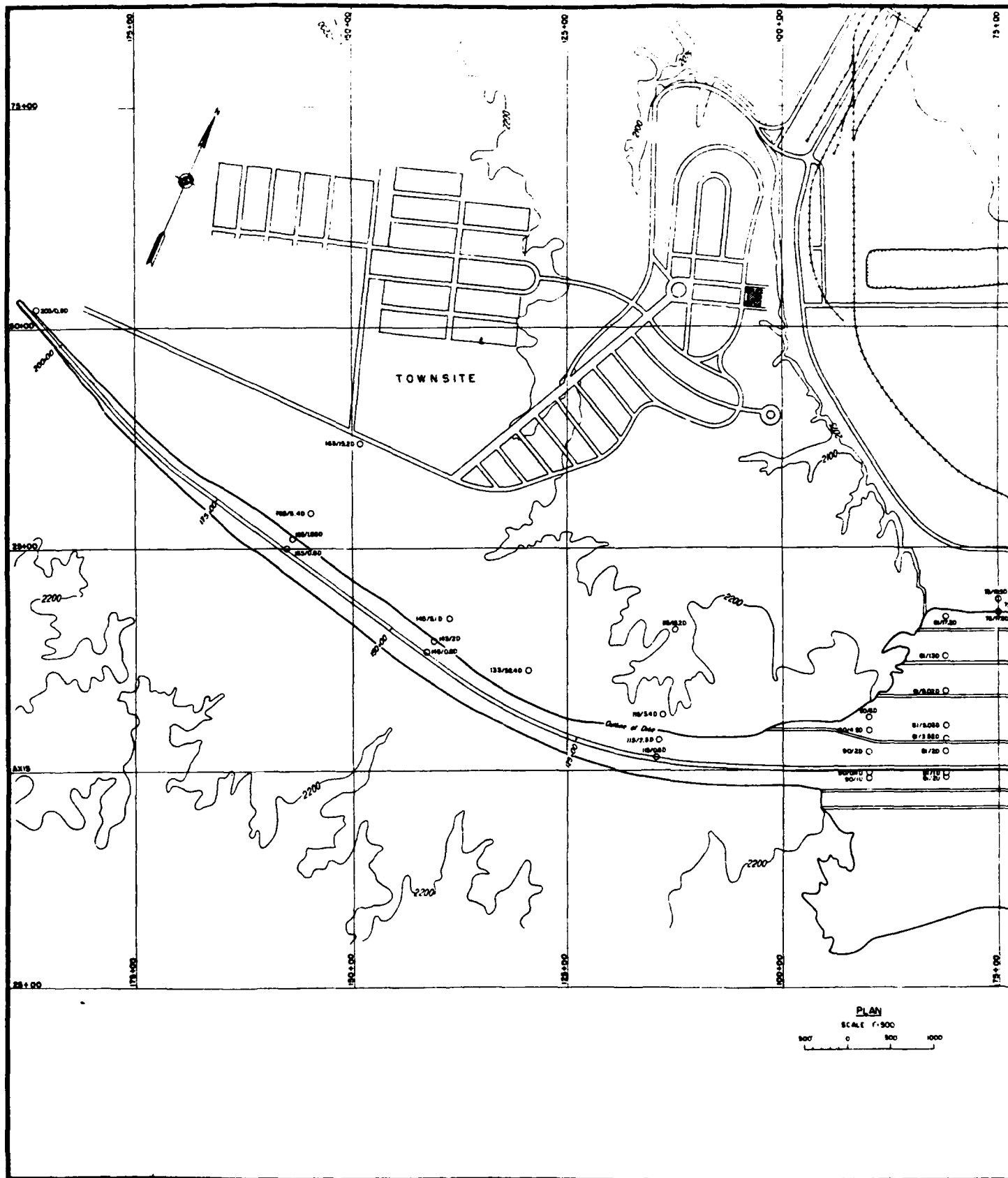


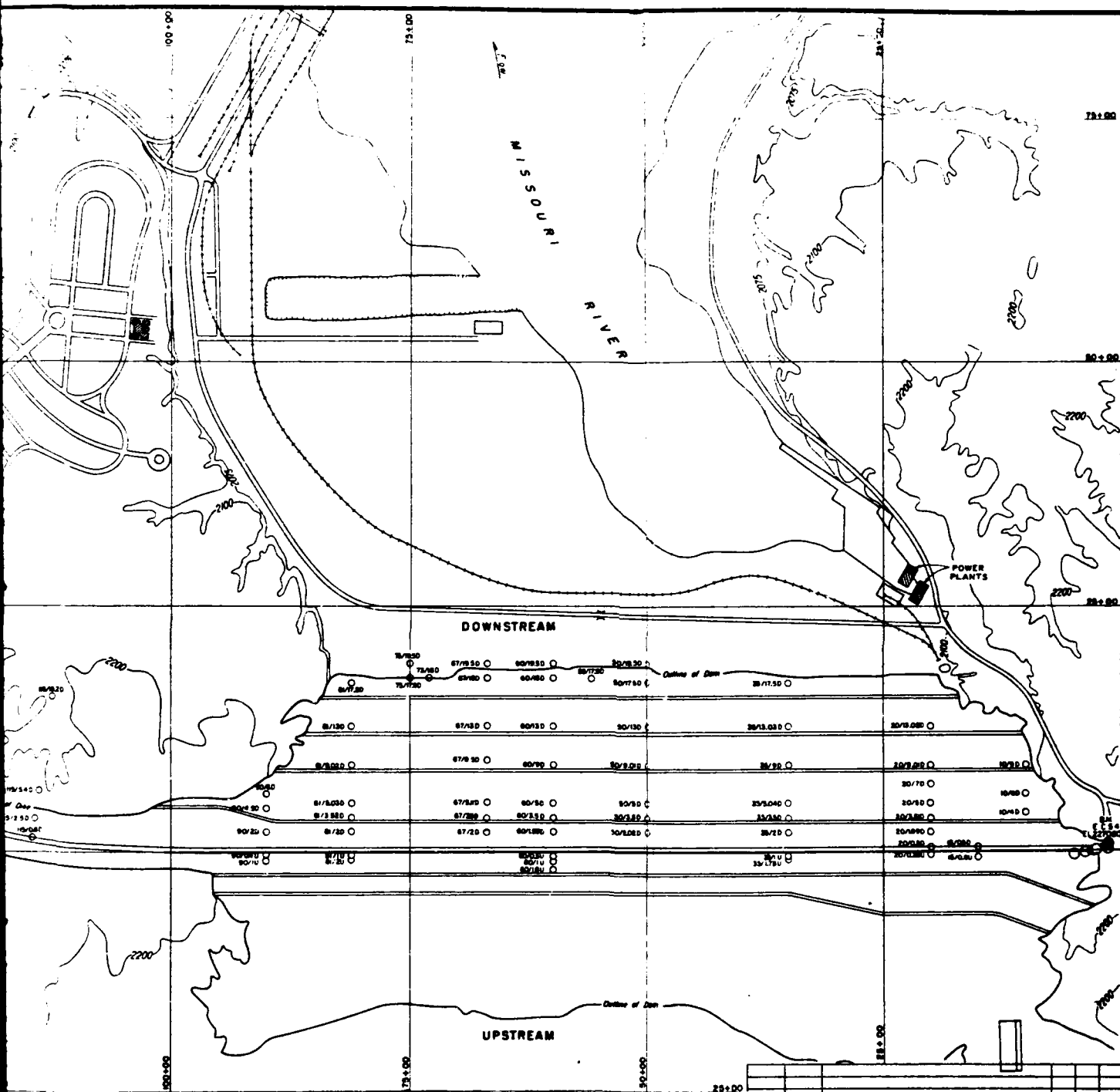
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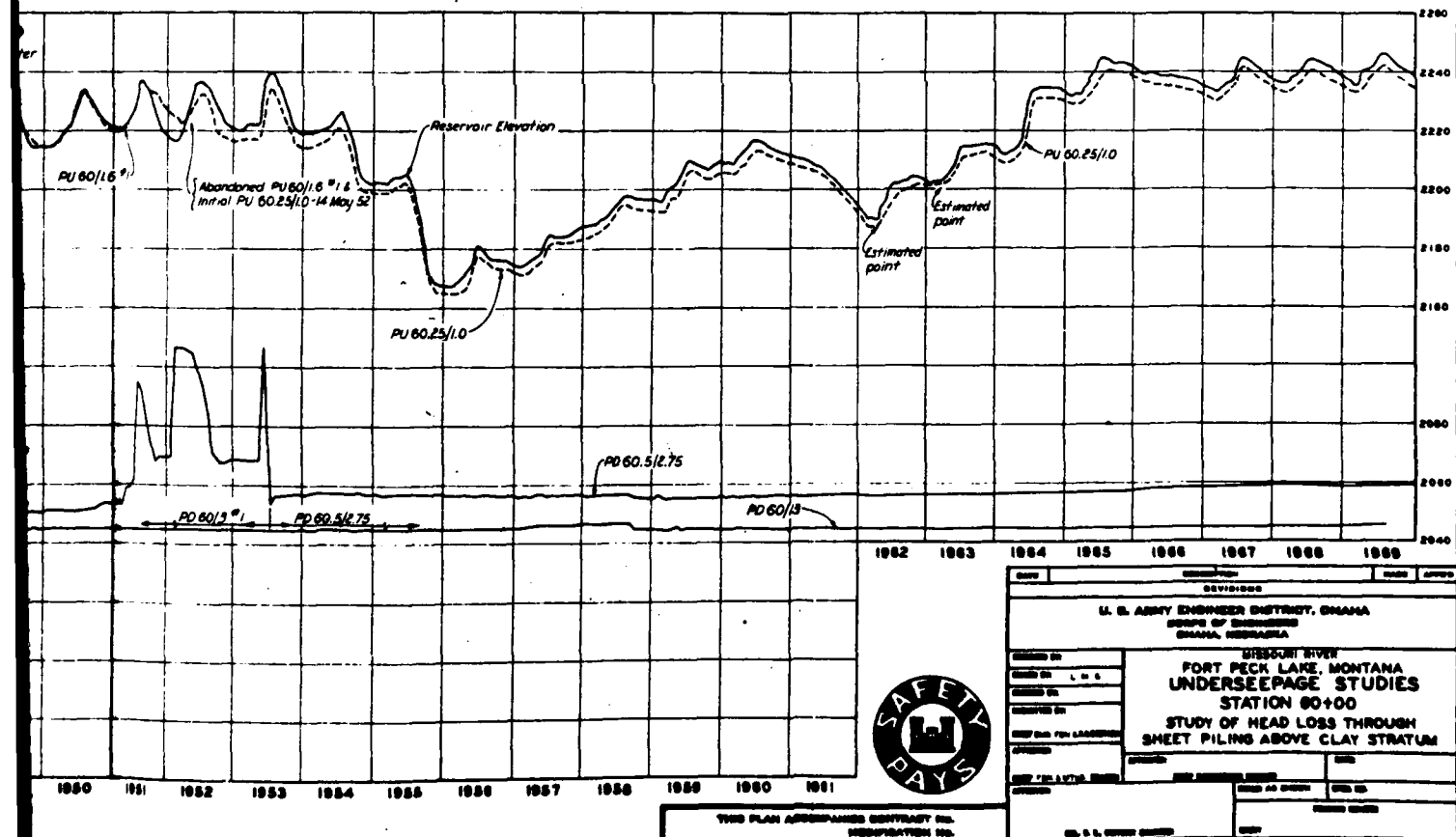
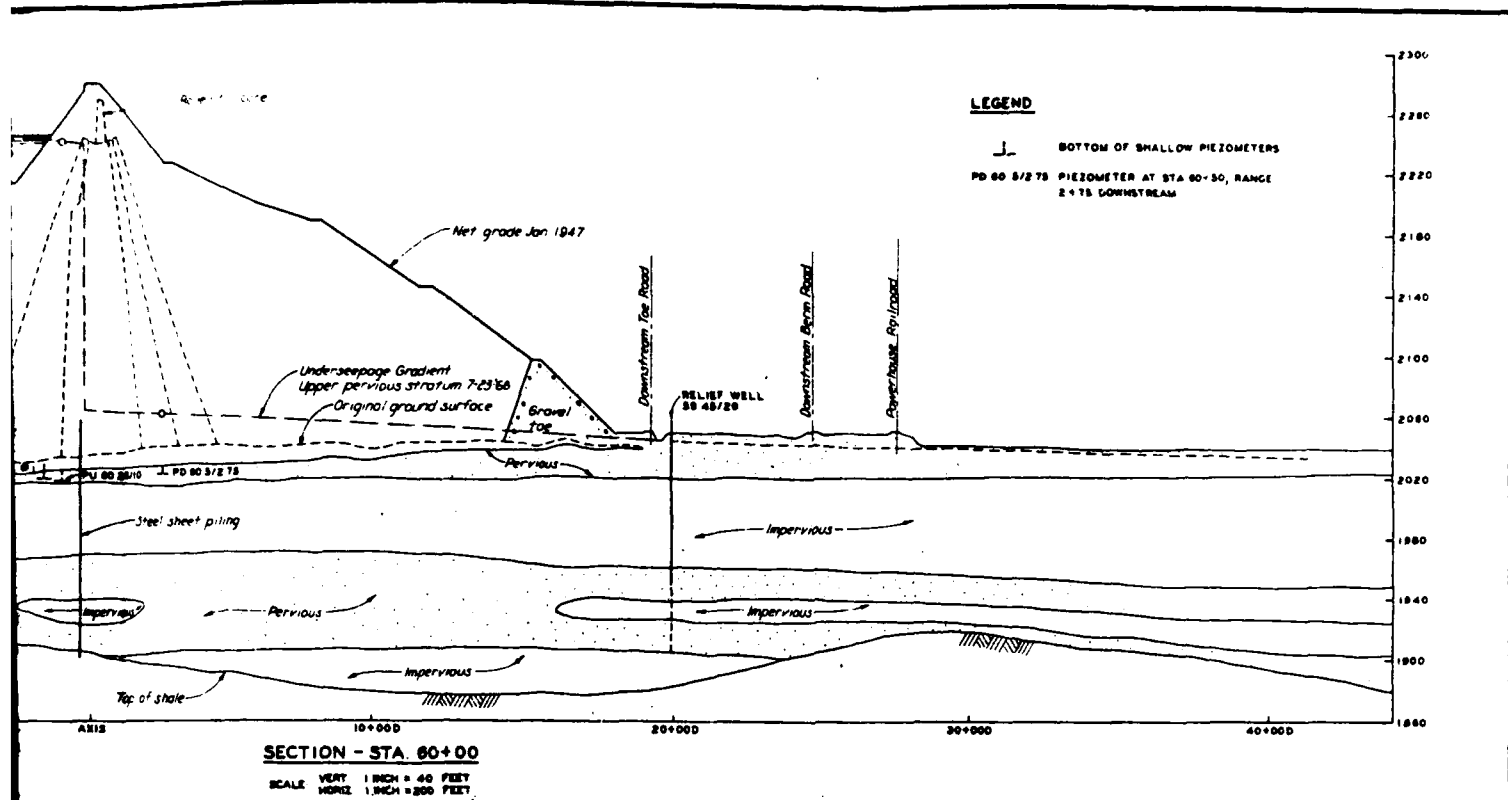


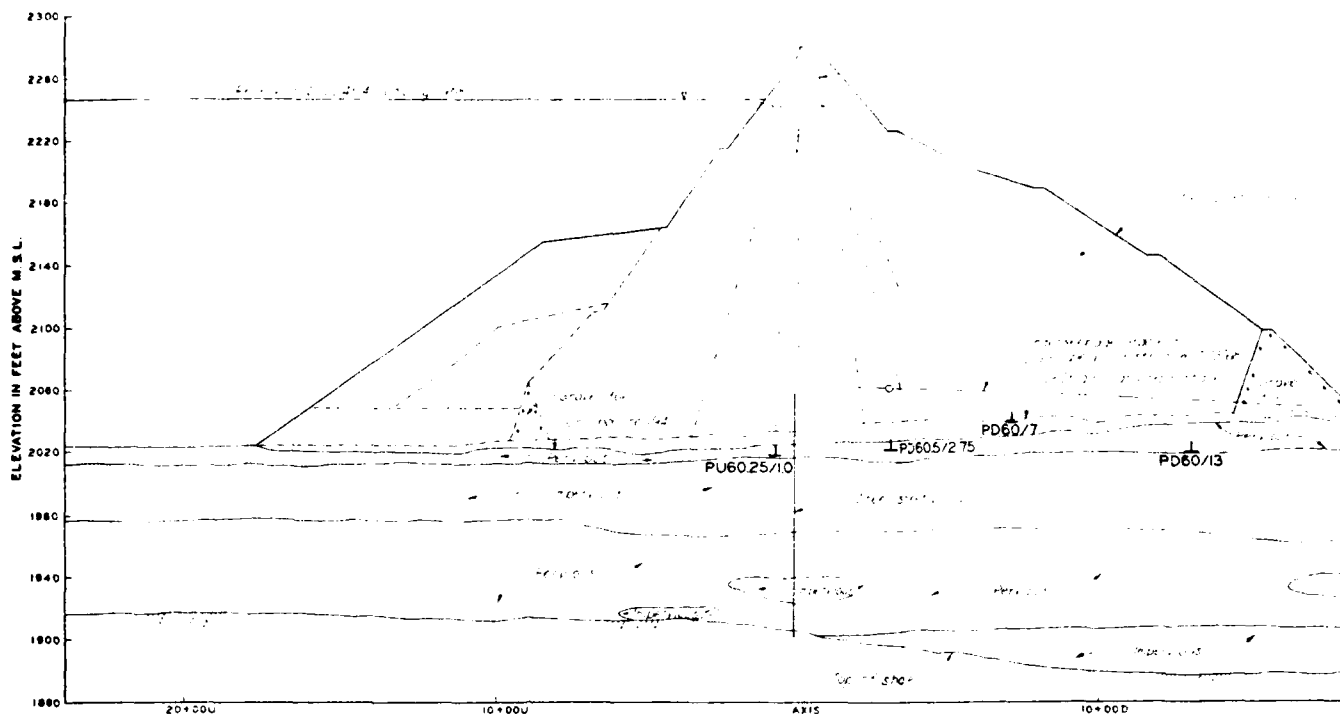
PLAN
SCALE 1"=500'

900' 0 900' 1000'

THIS DRAWING HAS BEEN REDUCED TO
FOUR-FIFTHS OF ORIGINAL SCALE.

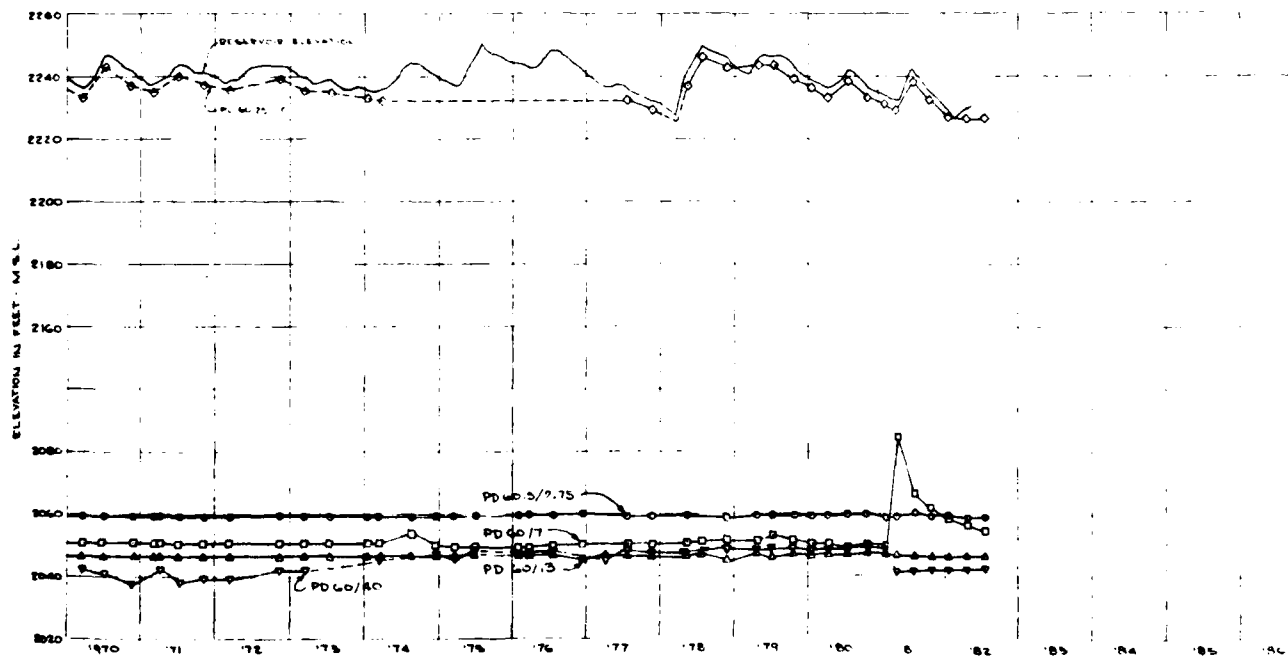
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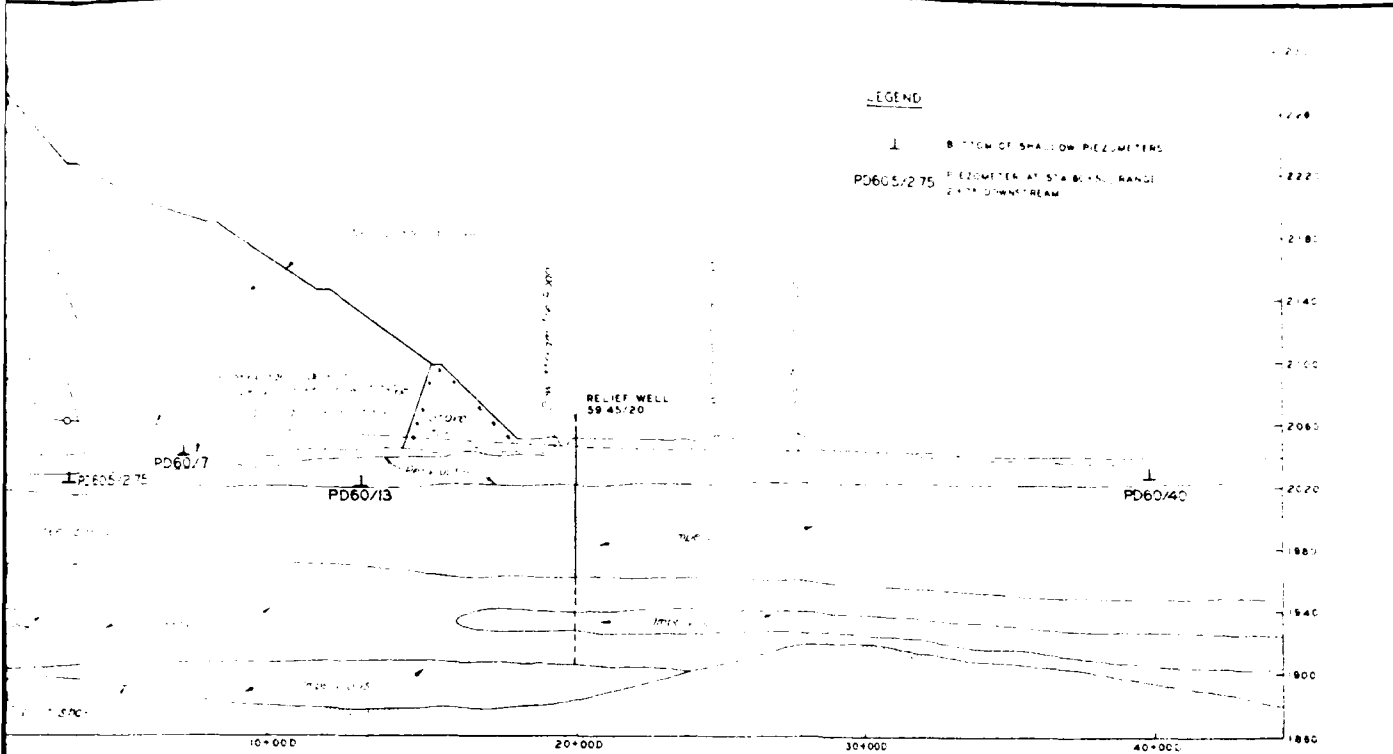
SECTION - STA 60+00

SCALE VERT 1 INCH = 40 FEET
HORIZ 1 INCH = 200 FEET



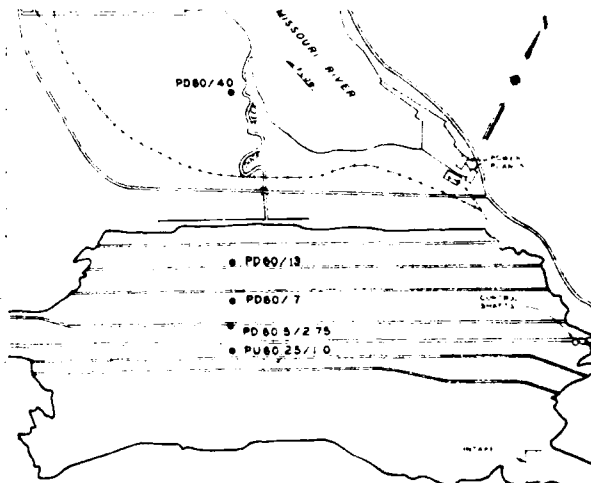
LEGEND

- 1 BOTTOM OF SHALLOW PIEZOMETERS
- PD605/275 PIEZOMETER AT STA 60+15, RANGE 2 1/2 MILES DOWNSTREAM



SECTION - STA 60+00

SCALE VERT 1 INCH = 40 FEET
HORIZ 1 INCH = 200 FEET



DATE	DESCRIPTION	MADE	APPROD
DIVISION			
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA			
DESIGNED BY	MISSOURI RIVER FORT PECK LAKE MONTANA UNDERSEEPAGE STUDIES STATION 60+00 STUDY OF HEAD LOSS THROUGH SHEET PILING ABOVE CLAY STRATUM		
DRAWN BY	DATE	APPROVED	
CHECKED BY	DATE	APPROVED	
APPROVED	DATE	APPROVED	
APPROVED	DATE	APPROVED	

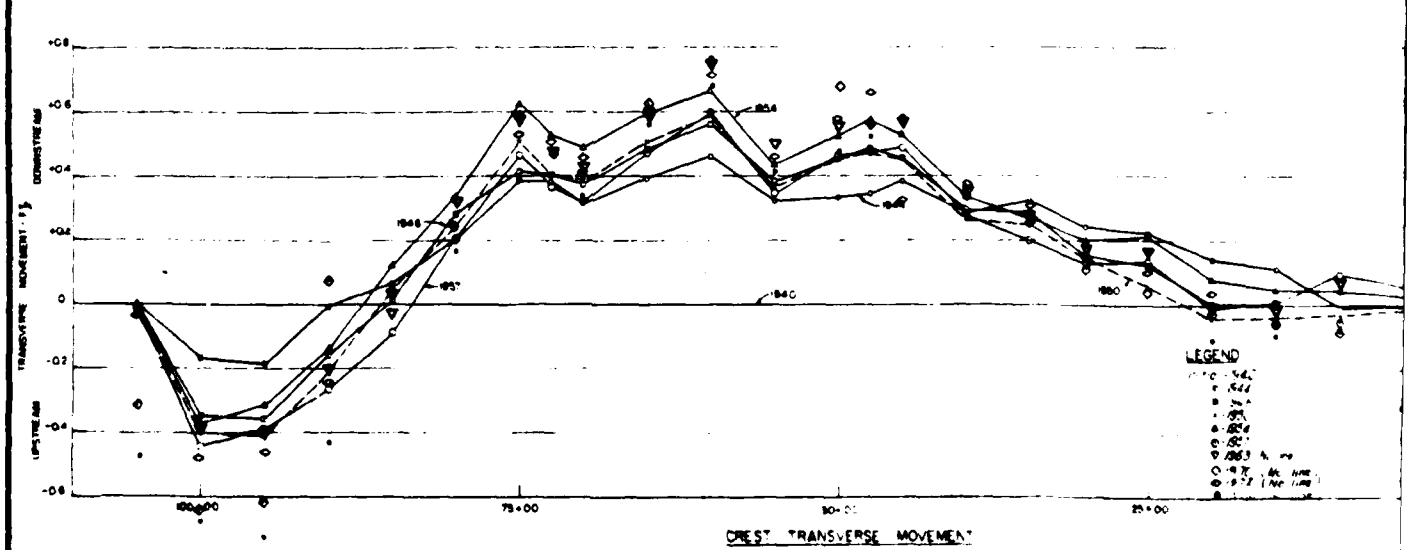
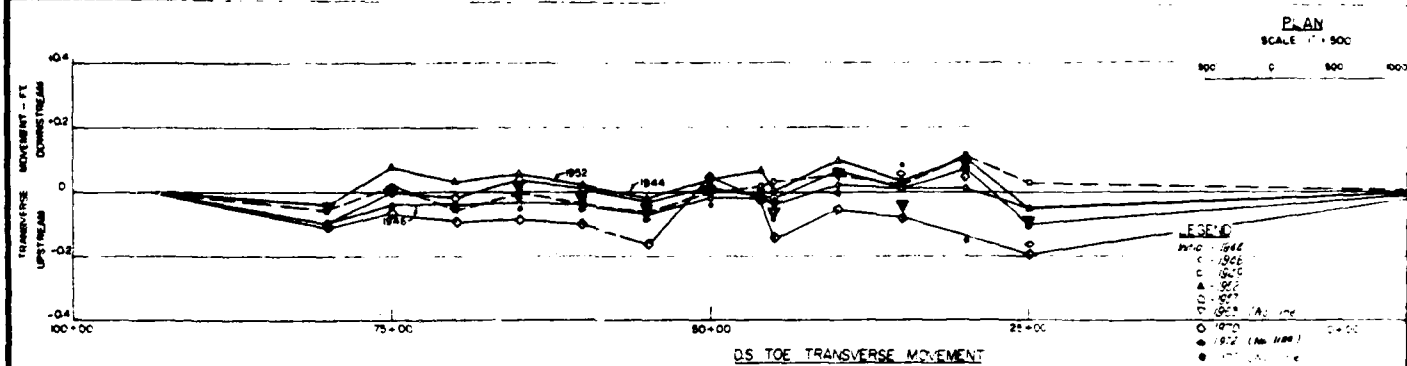
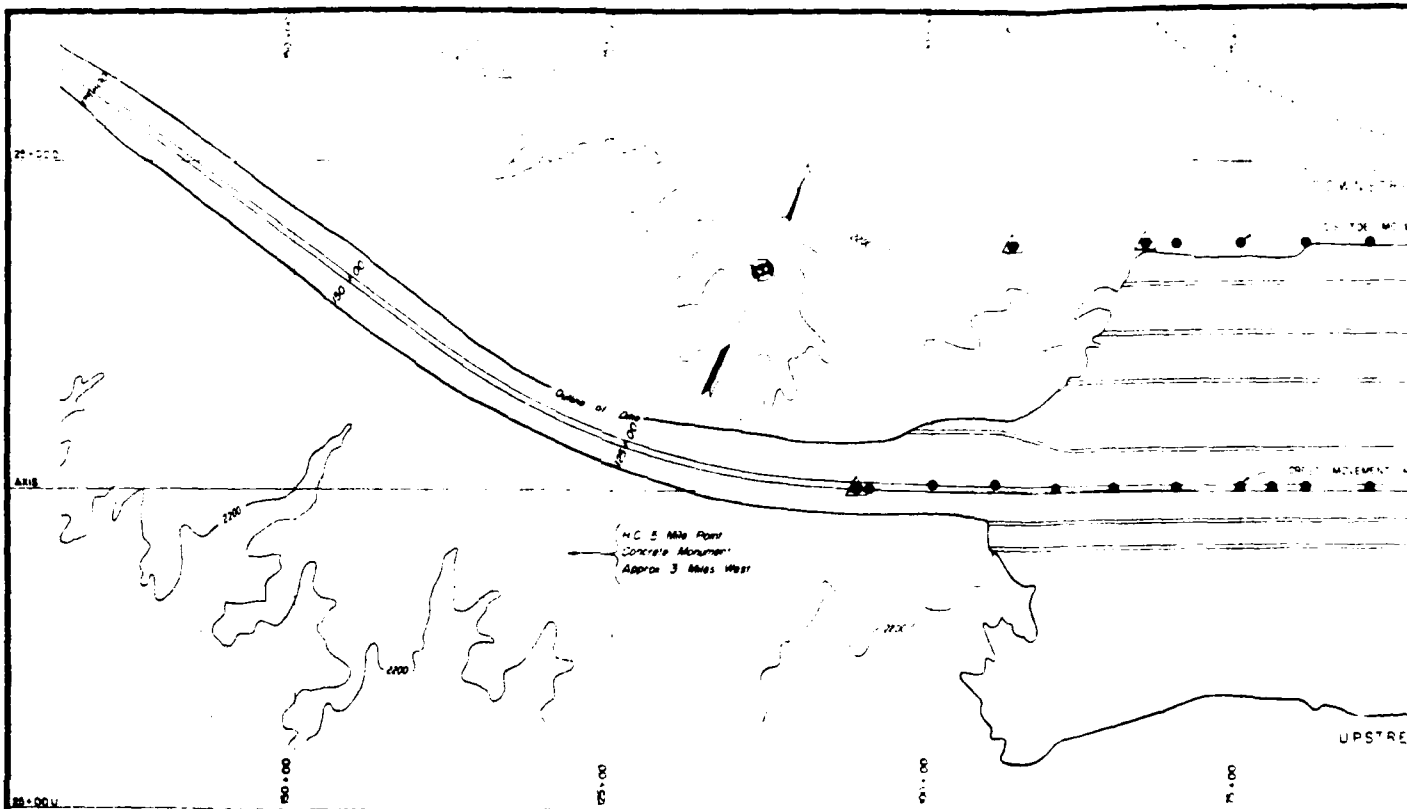


THIS DRAWING HAS BEEN RECHECKED BY
TABLET-60/25 THE DATA HAS BEEN

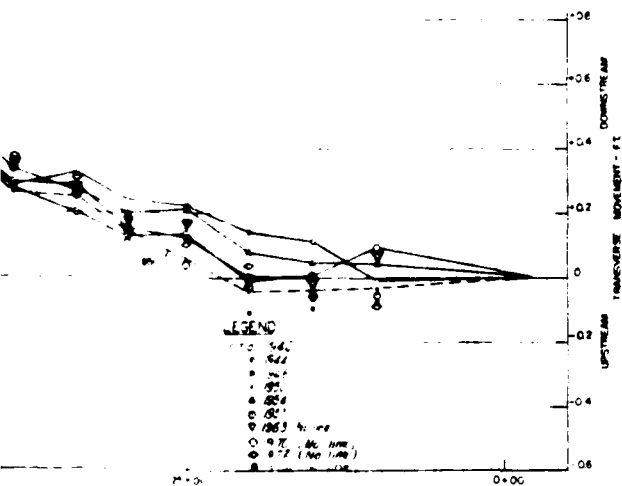
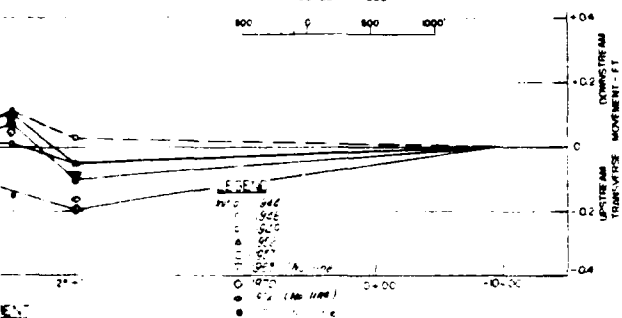
THIS PLAN ACCOMPANIES CONTRACT NO
MODIFICATION NO

CONSTRUCTION FOUNDATION REPORT

PLATE 55

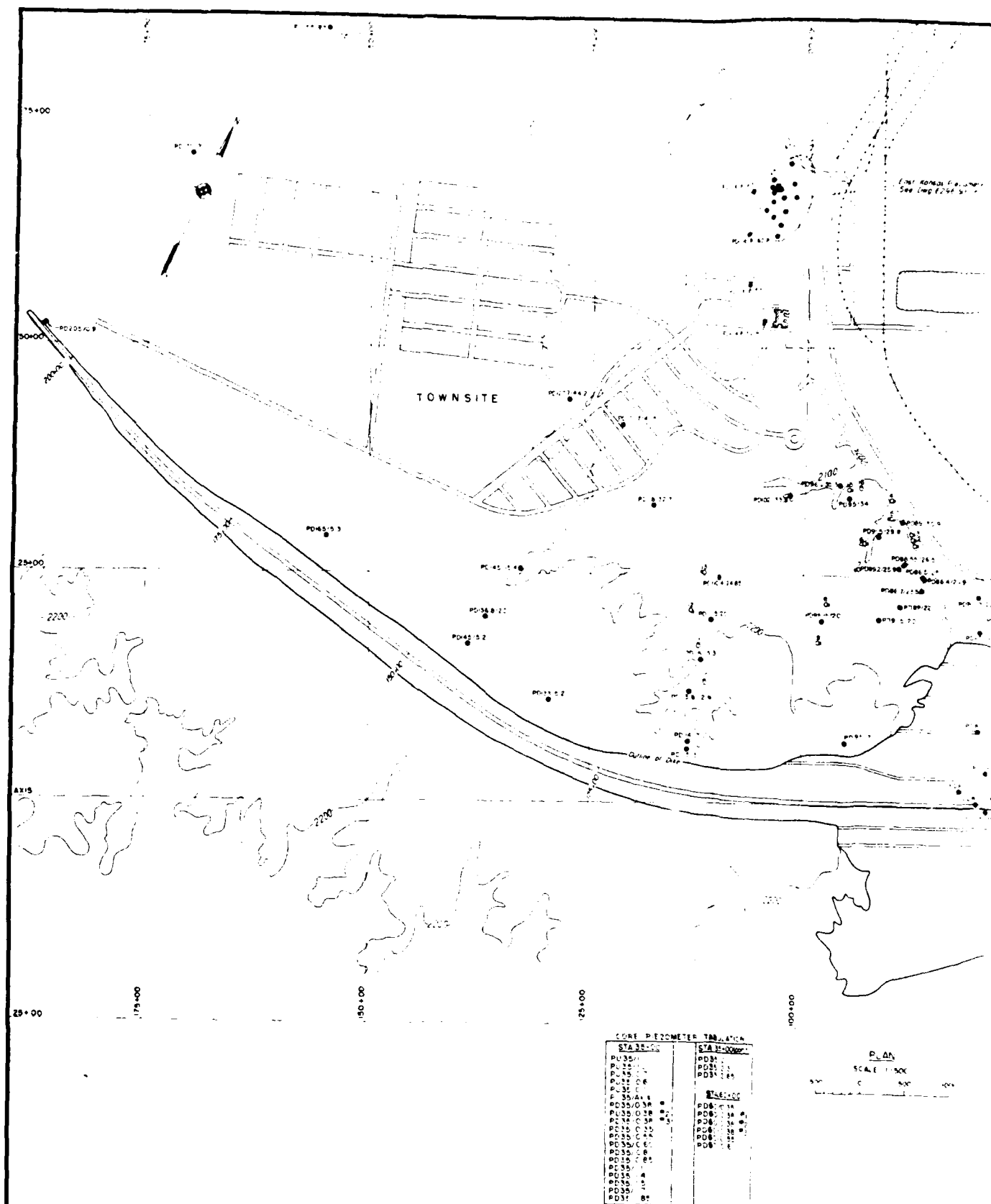


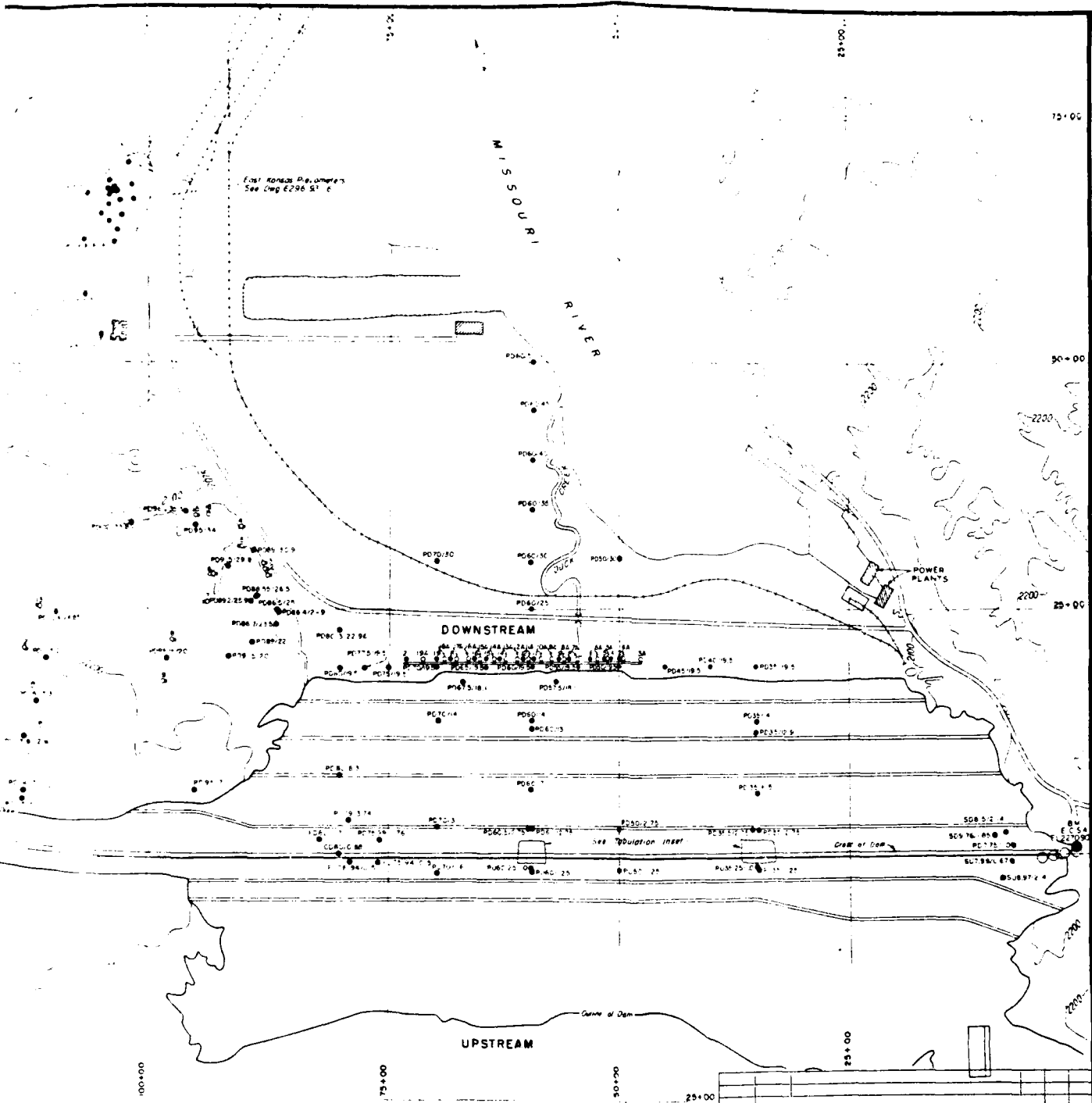
BOO 9 BOO BOO

[illegible]

Note Locations as of May 1982

REF		DATE		REVISION DESCRIBED BY		BY	DATE	APP								
<p align="center">CORPS OF ENGINEERS, U. S. ARMY OFFICE OF THE DISTRICT ENGINEER SANBORN DISTRICT BRIDGEE, N.Y.</p>																
<table border="1"> <tr> <td>DESIGNED</td> <td>DATE</td> </tr> <tr> <td>CONSTRUCTED</td> <td>DATE</td> </tr> <tr> <td>TESTED</td> <td>DATE</td> </tr> <tr> <td>APPROVED</td> <td>DATE</td> </tr> </table>		DESIGNED	DATE	CONSTRUCTED	DATE	TESTED	DATE	APPROVED	DATE	<p align="center">MISSOURI RIVER FORT PECK DAM</p>						
DESIGNED	DATE															
CONSTRUCTED	DATE															
TESTED	DATE															
APPROVED	DATE															
<p align="center">HORIZONTAL MOVEMENT CONTROL PLAN - GRAPHIC - TABULATION</p>																
<table border="1"> <tr> <td>APPROVED</td> <td>DATE</td> </tr> <tr> <td>REVISIONS</td> <td>DATE</td> </tr> </table>		APPROVED	DATE	REVISIONS	DATE	<table border="1"> <tr> <td>APPROVAL, REQUIREMENTS</td> <td>DATE</td> </tr> <tr> <td></td> <td></td> </tr> </table>			APPROVAL, REQUIREMENTS	DATE			<p align="center">JUNE 1957</p>			
APPROVED	DATE															
REVISIONS	DATE															
APPROVAL, REQUIREMENTS	DATE															
<table border="1"> <tr> <td>REVISIONS</td> <td>DATE</td> </tr> <tr> <td></td> <td></td> </tr> </table>		REVISIONS	DATE			<table border="1"> <tr> <td> <p align="center">65-93C-33</p> </td> </tr> </table>							<p align="center">65-93C-33</p>			
REVISIONS	DATE															
<p align="center">65-93C-33</p>																





PIEZOMETER TAB.

STATION	PIEZOMETER	RELIEF WELL
PC 31	PC 31	
PC 32	PC 32	
PC 33	PC 33	
PC 34	PC 34	
PC 35	PC 35	
PC 36	PC 36	
PC 37	PC 37	
PC 38	PC 38	
PC 39	PC 39	
PC 40	PC 40	
PC 41	PC 41	
PC 42	PC 42	
PC 43	PC 43	
PC 44	PC 44	
PC 45	PC 45	
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PC 86	PC 86	
PC 87	PC 87	
PC 88	PC 88	
PC 89	PC 89	
PC 90	PC 90	
PC 91	PC 91	
PC 92	PC 92	
PC 93	PC 93	
PC 94	PC 94	
PC 95	PC 95	
PC 96	PC 96	
PC 97	PC 97	
PC 98	PC 98	
PC 99	PC 99	
PC 100	PC 100	

PLAN
SCALE 1" = 500'

LEGEND

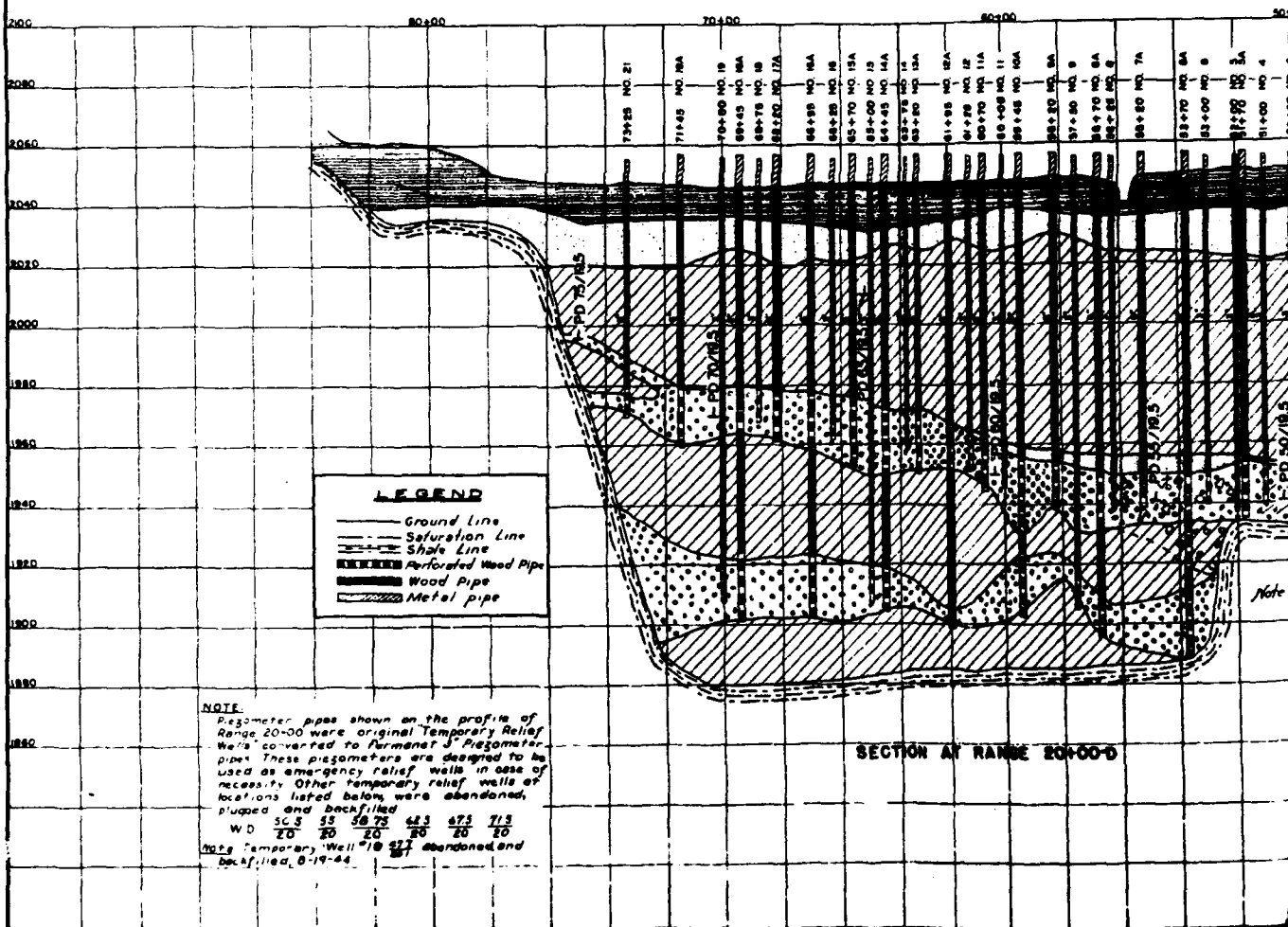
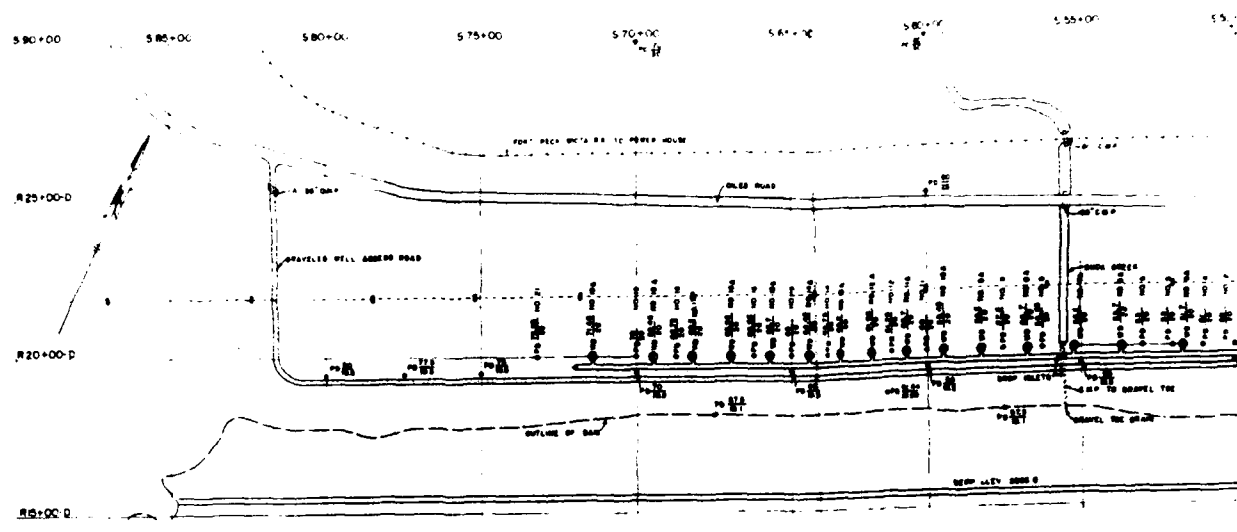
- - Piezometer
- - Pressure Relief Well

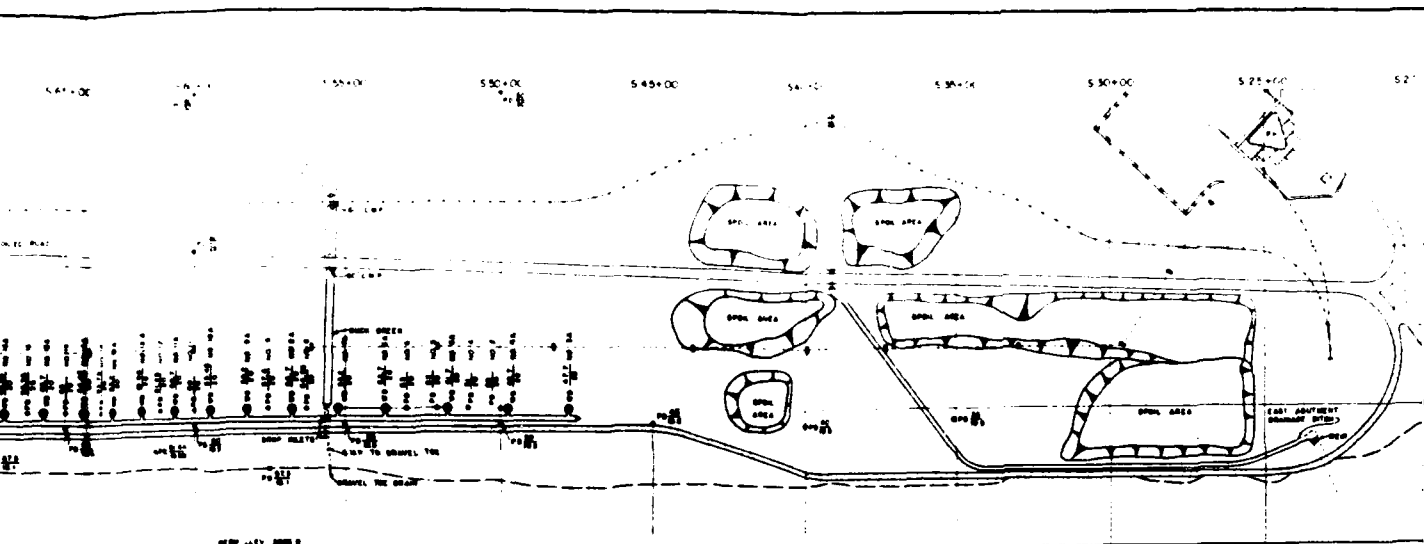
NOTE

Piezometer Explanation
PC 35 / 110' Downstream from E
Station 35+00
Downstream

CORPS OF ENGINEERS, U. S. ARMY OFFICE OF THE DISTRICT ENGINEER QUARTERS DISTRICT BENTLEY BLDG.	
MISSOURI RIVER FORT PECK DAM LOCATION OF PIEZOMETERS AND RELIEF WELLS MAIN DAM AND LEFT ABUTMENT	
DATE: AUGUST 1957	PROJECT: 6296-92-1-69
DRAWN BY: [Signature]	
CHECKED BY: [Signature]	
APPROVED BY: [Signature]	
REVISIONS: [Table]	

2





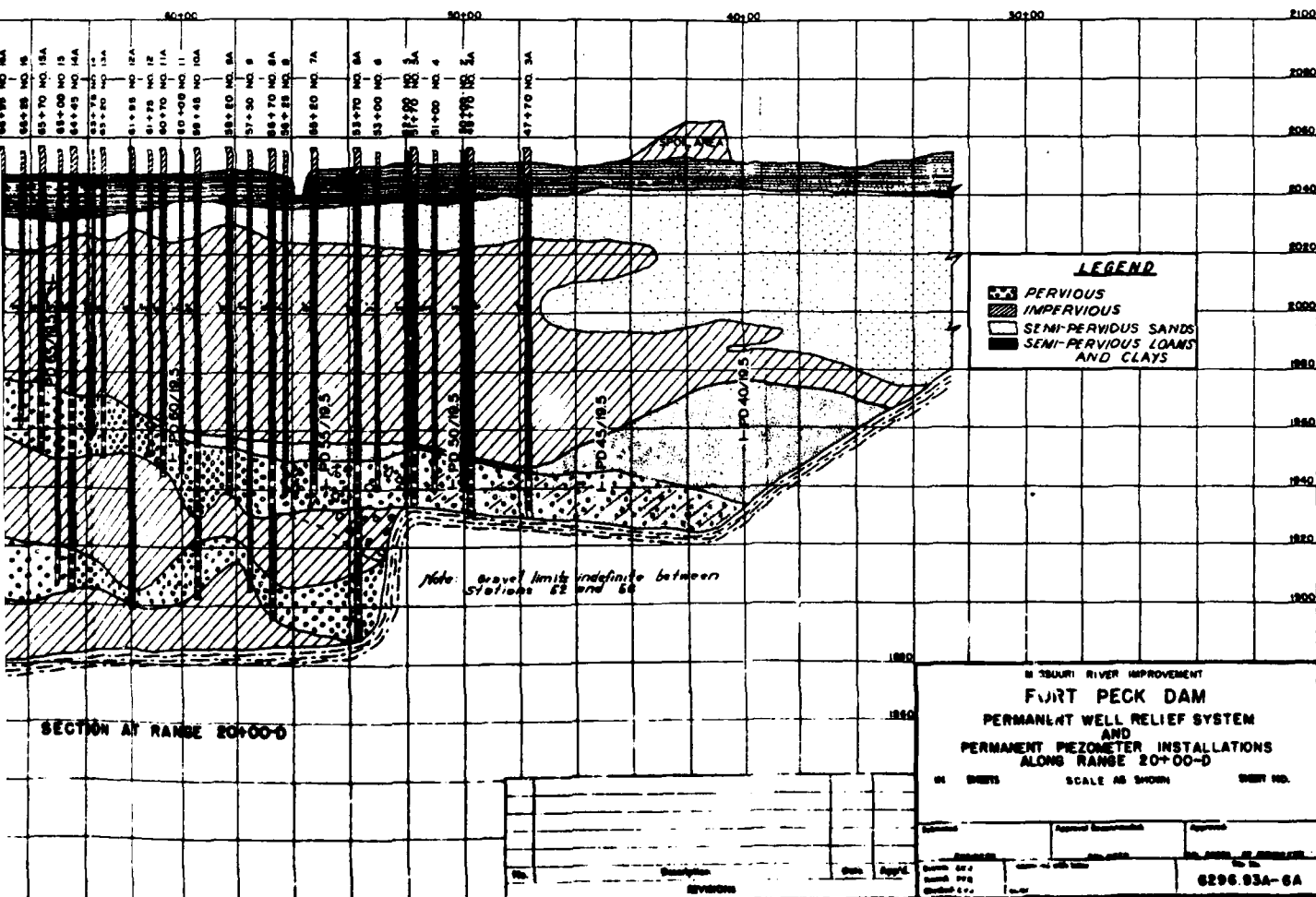
PLAN

SCALE 0 100 200 300 400 500 FEET

LEGEND

- Permanent Pressure Relief Wells
- Piezometer Pipe (Existing)

THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE.



LEGEND

- PERVIOUS
- IMPERVIOUS
- SEMI-PERVIOUS SANDS
- SEMI-PERVIOUS LOAMS AND CLAYS

Note: Gravel limits indefinite between Stations 52 and 54

SECTION AT RANGE 20+00-0

MISSOURI RIVER IMPROVEMENT
FORT PECK DAM
PERMANENT WELL RELIEF SYSTEM
AND
PERMANENT PIEZOMETER INSTALLATIONS
ALONG RANGE 20+00-0

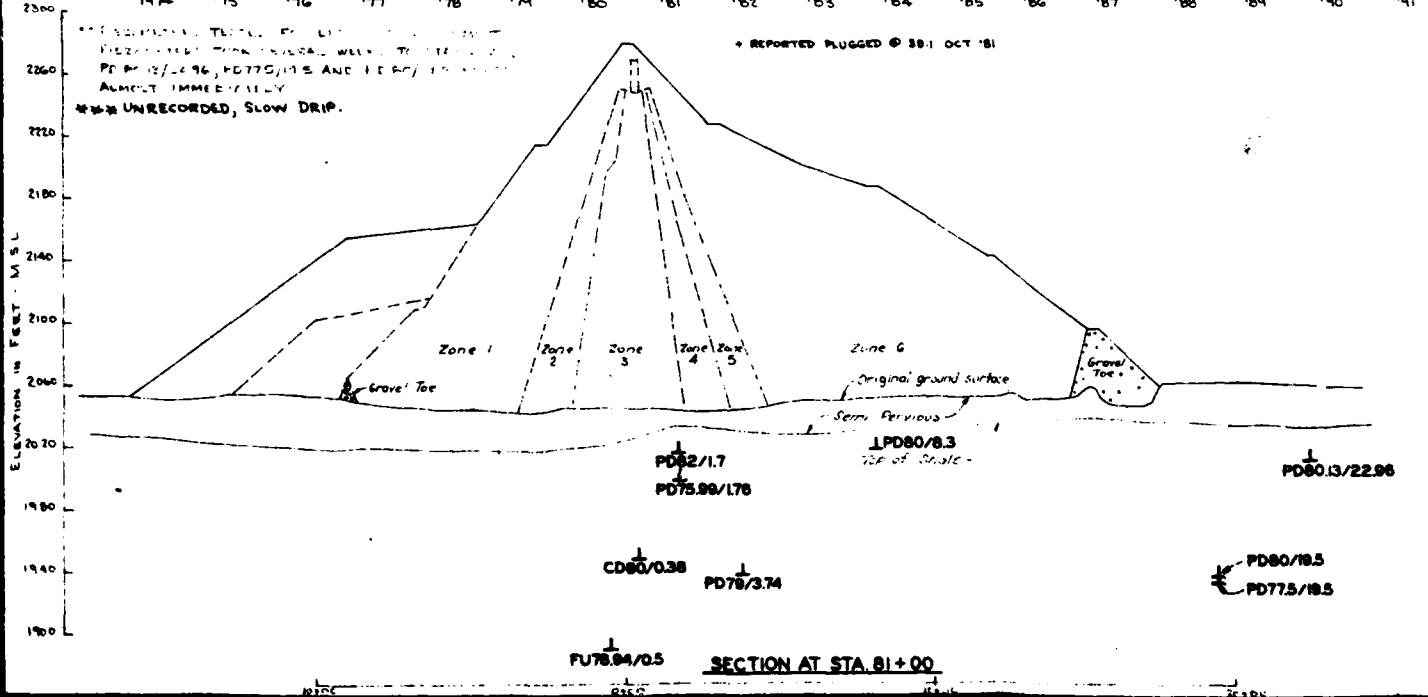
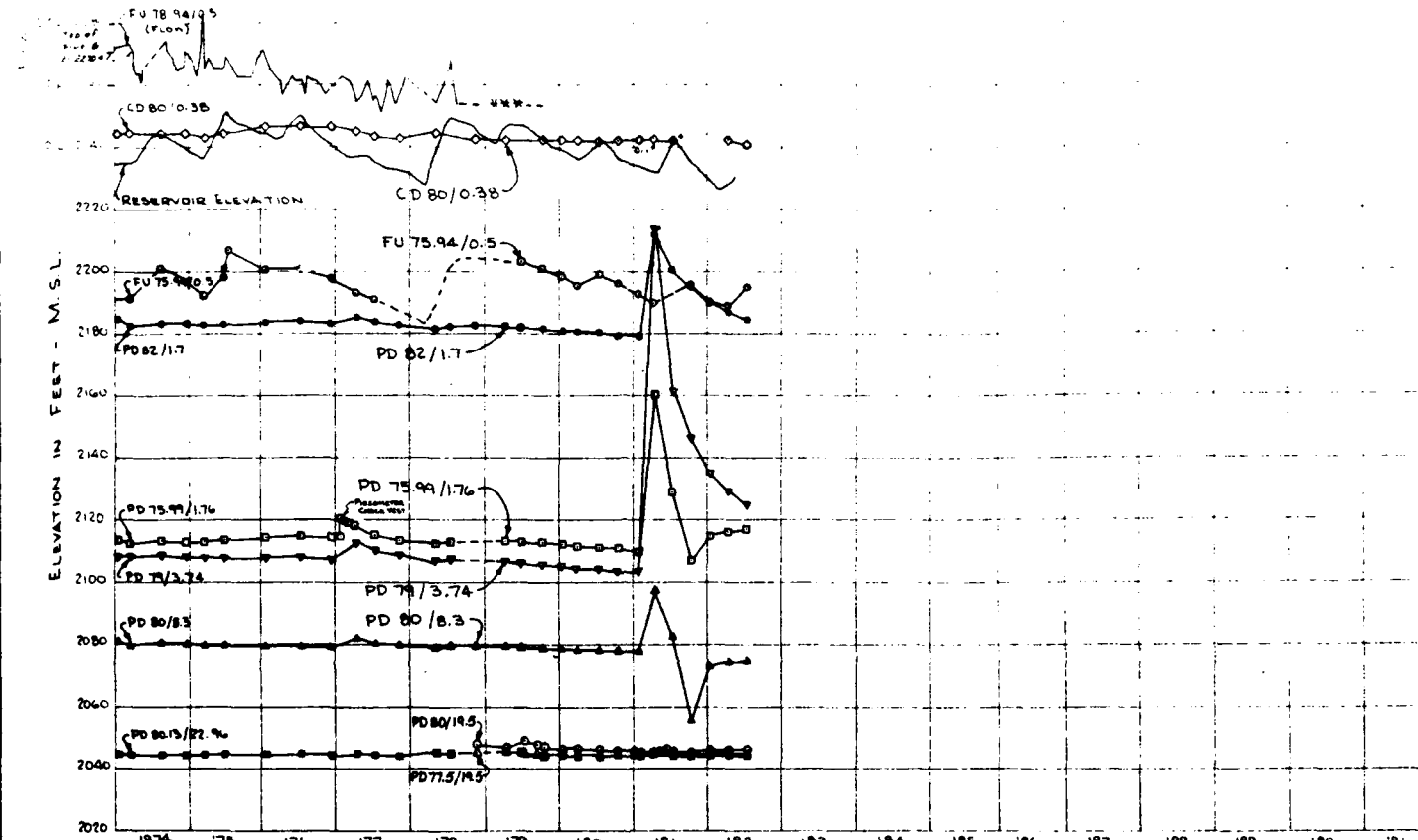
IN SHEETS SCALE AS SHOWN SHEET NO.

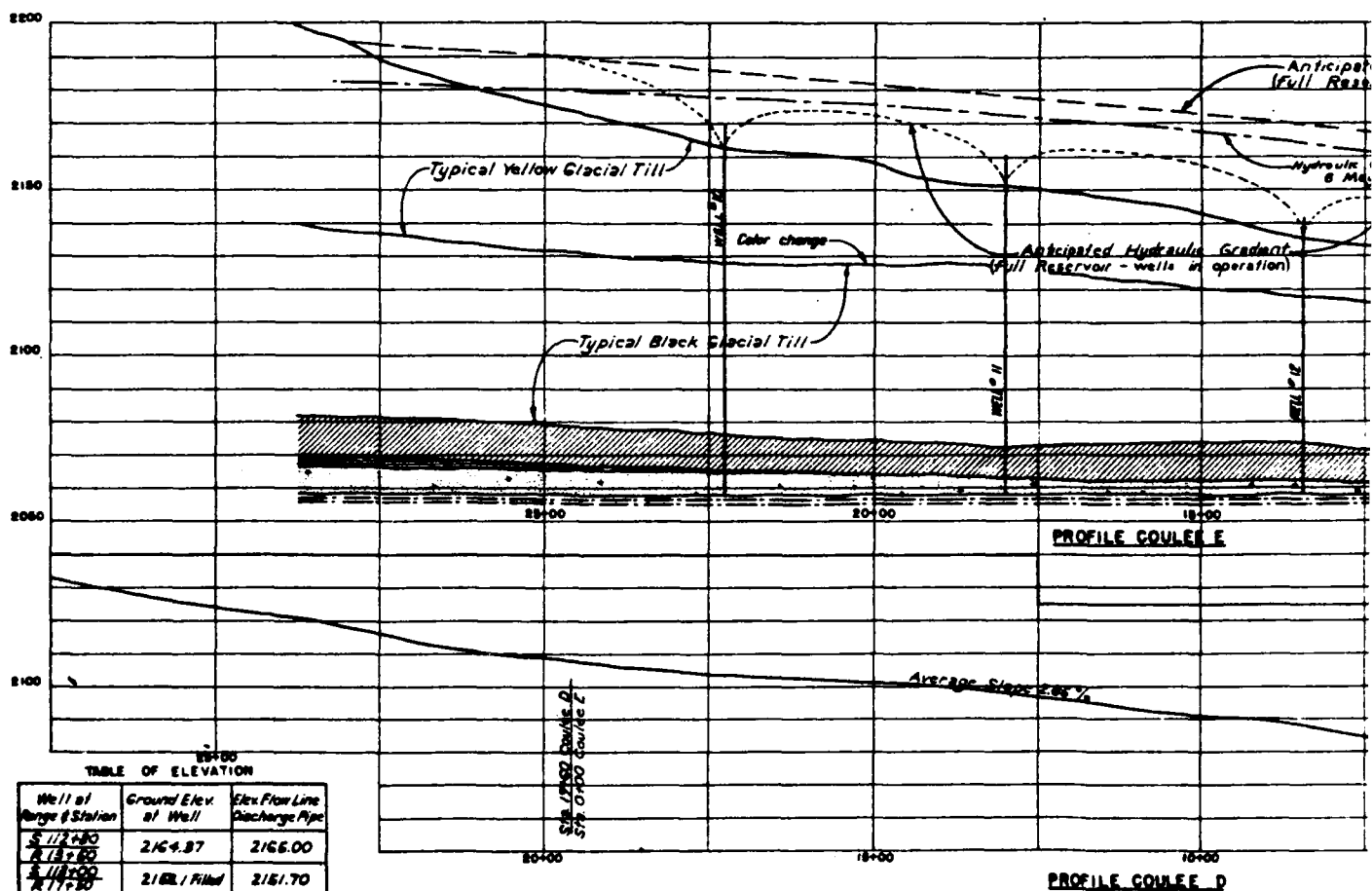
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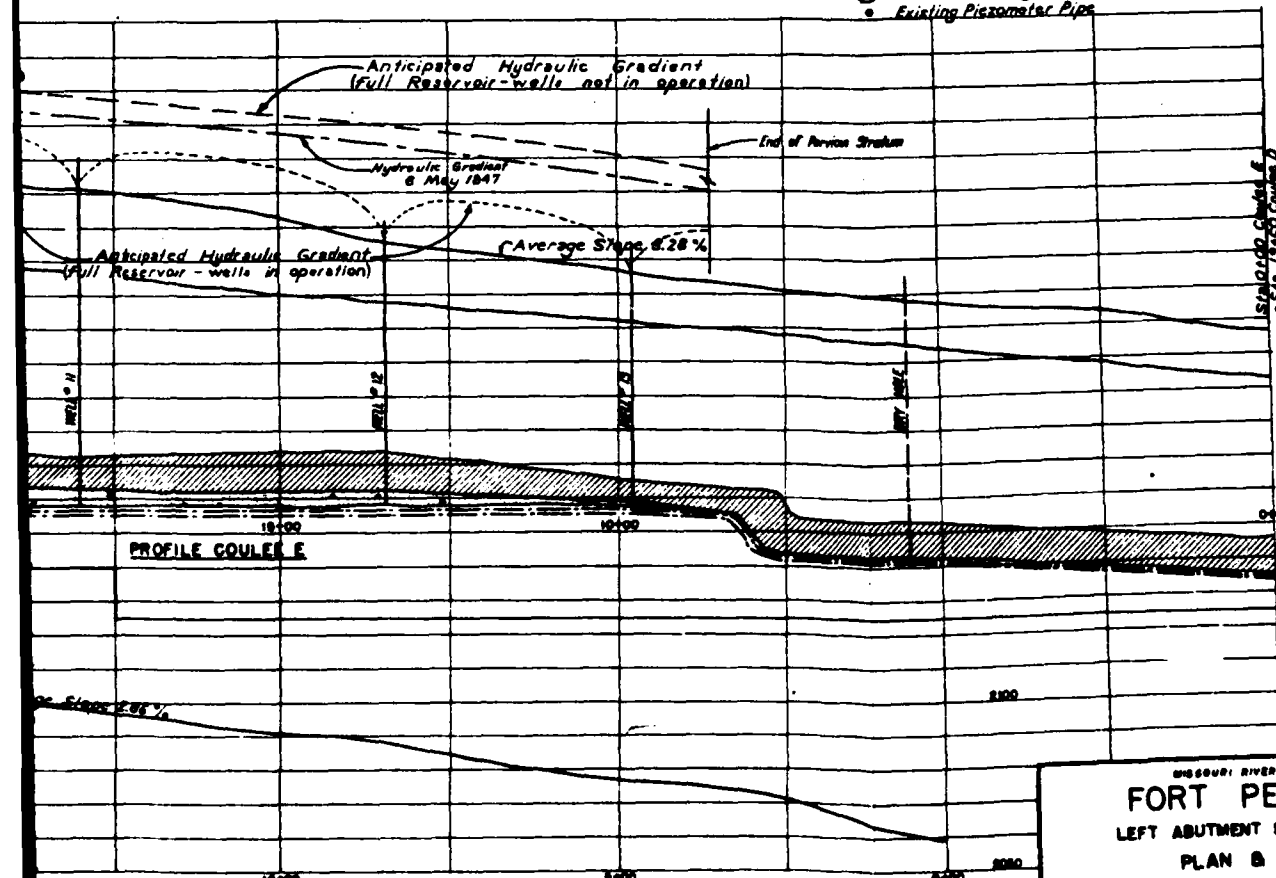
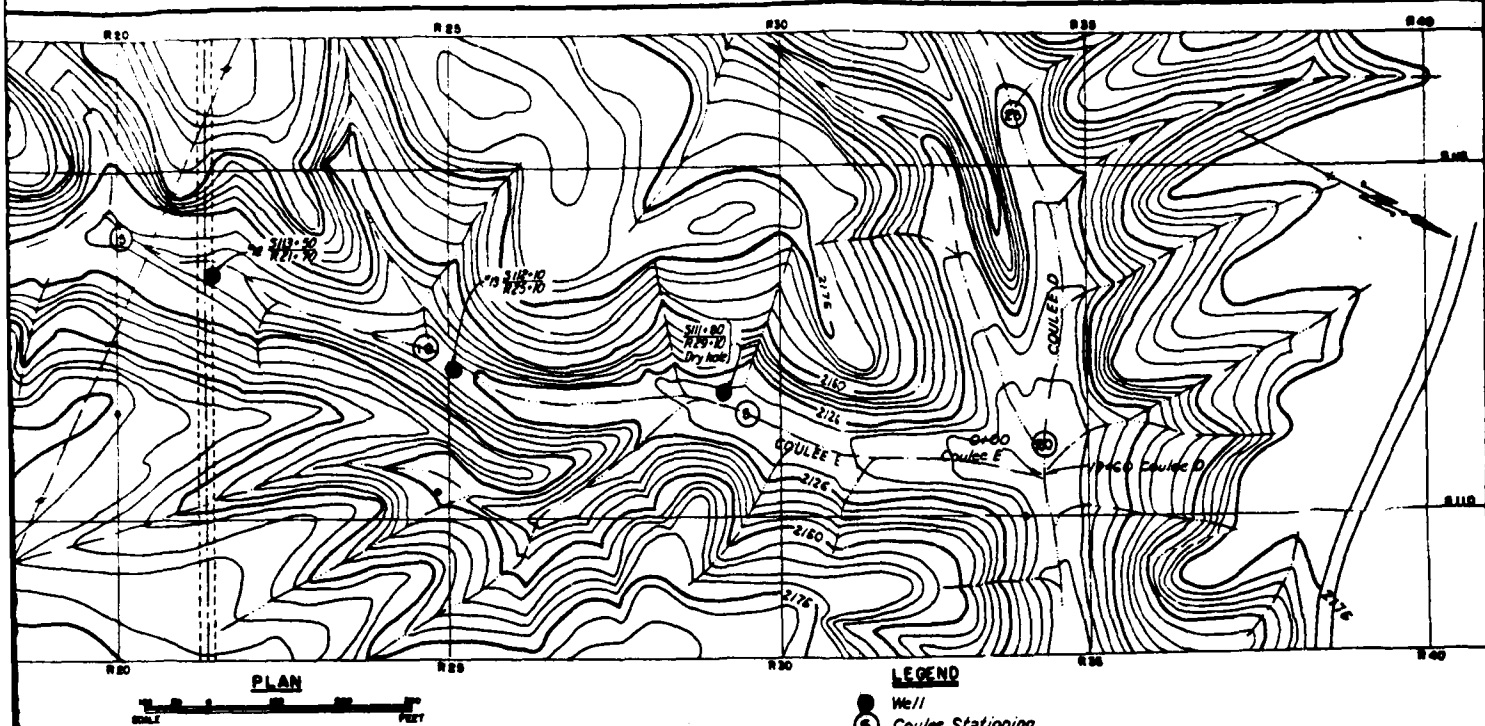
CONSTRUCTION FOUNDATION REPORT

PLATE 58

2



[illegible]



MISSOURI RIVER IMPROVEMENT **FORT PECK DAM** LEFT ABUTMENT SEEPAGE SYSTEM PLAN & PROFILE

IN 2 SHEETS

SCALE AS SHOWN

SHEET NO. 2

3	Soil Profile Revised to As Built	5-15-57	
2	Well Numbers Added	1-28-58	
1	Corrected Well Locations	1-16-57	CVJ
No.	Description	Date	App'd

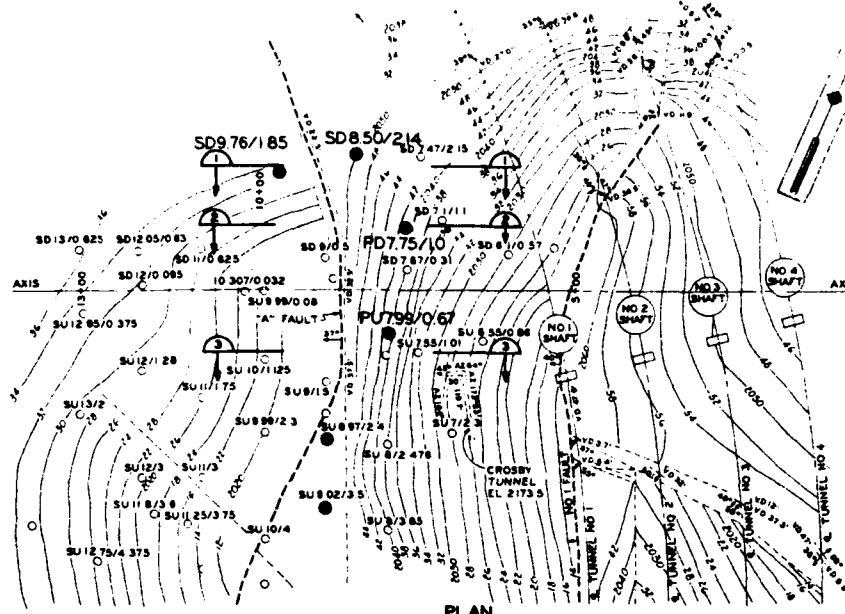
REVISED

U. S. ENGINEER OFFICE, FORT PECK, MONTANA

9 MAY 1947

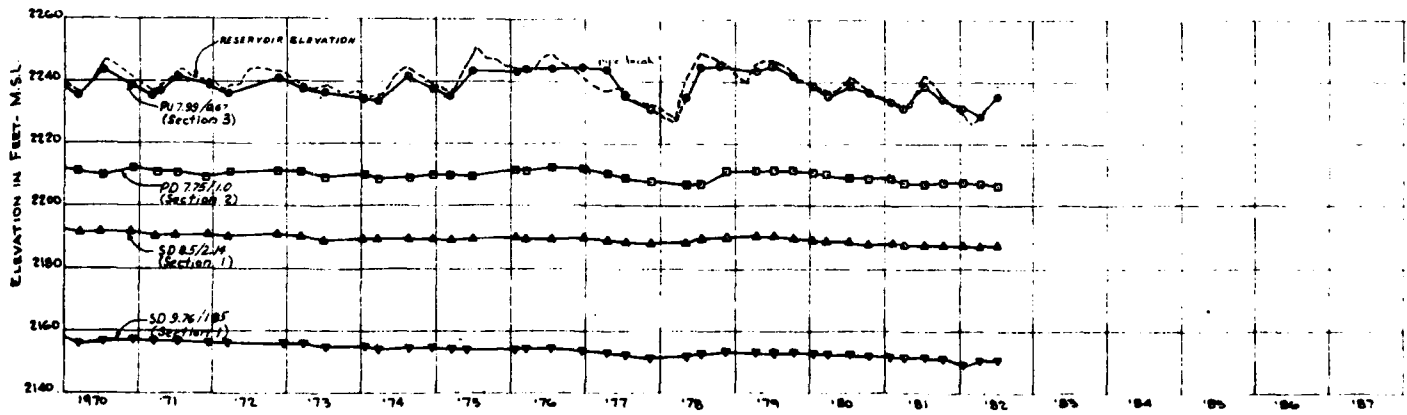
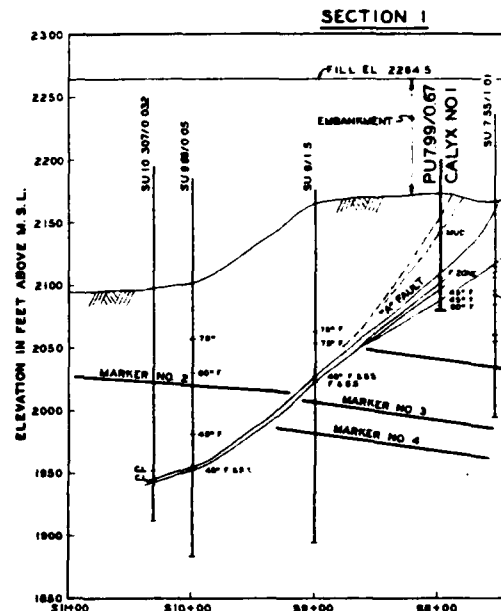
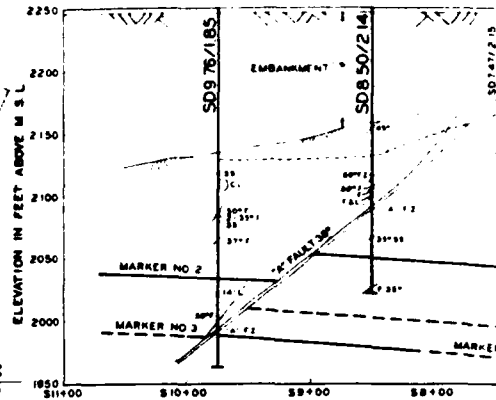
U. S. ENGINEER OFFICE, FORT PECK, MONTANA
 6296.93C-4

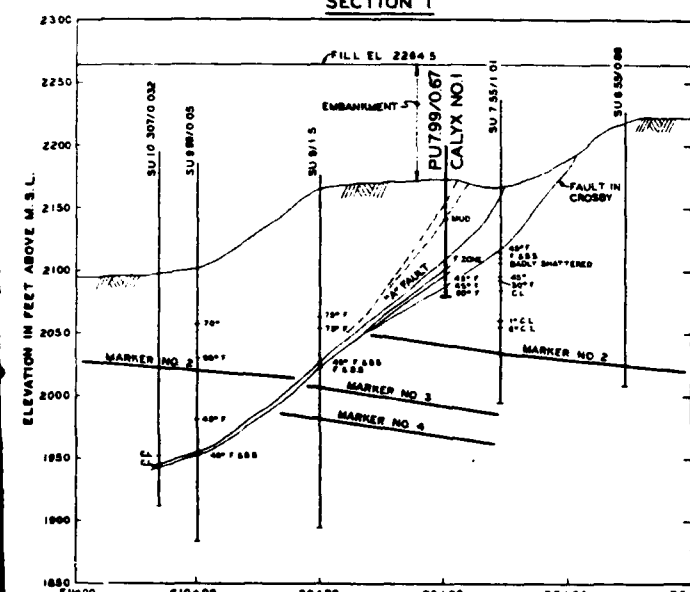
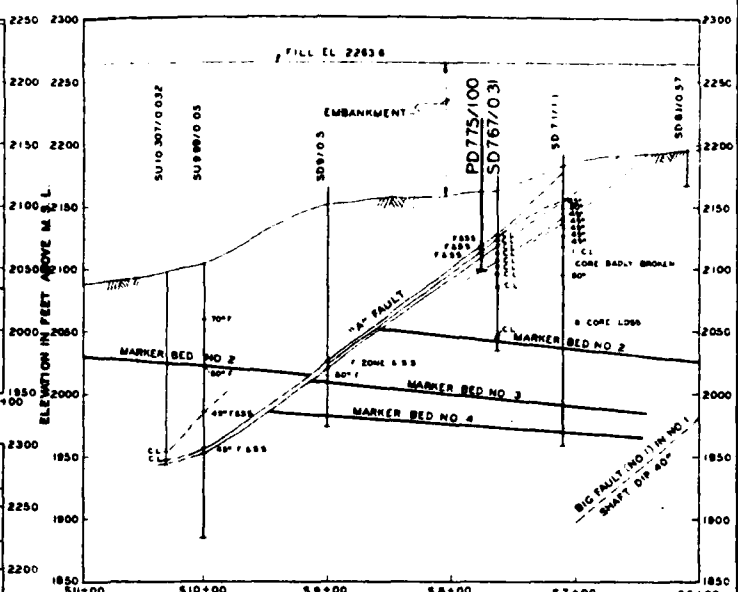
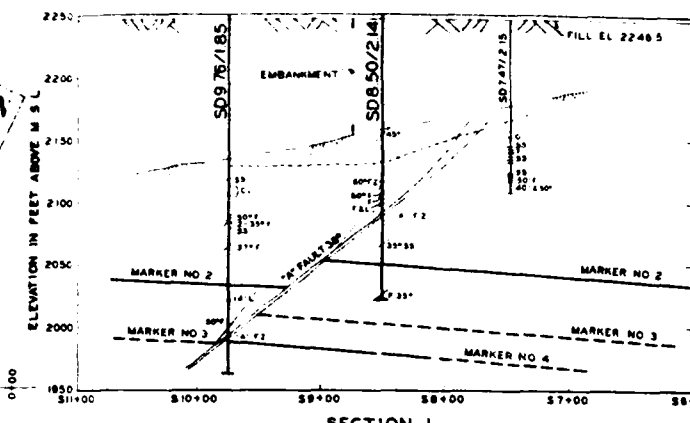
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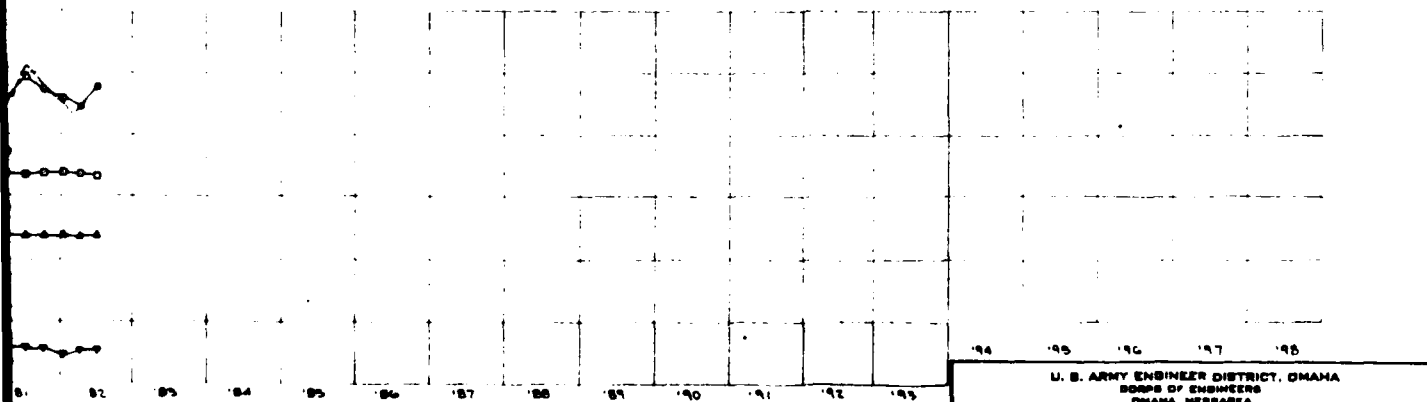
LEGEND:

- STRIKE AND DIP
- V.D. VERTICAL DISPLACEMENT
- SD SLIDE AREA BORINGS DOWNSTREAM
- SU SLIDE AREA BORINGS UPSTREAM
- FAULT
- SPECIAL BORINGS FOR "A" FAULT OBSERVATION
- EXPLORATORY BORINGS





- LEGEND:**
- SS SLICKENSIDES
 - CL CORE LOSS
 - SH SHATTERED
 - 45° F FAULT PLANE
 - HW HANGING WALL
 - F & SS FAULT PLANE WITH SLICKENSIDES
 - MARKER NO MARKER BEDS OF BENTONITE

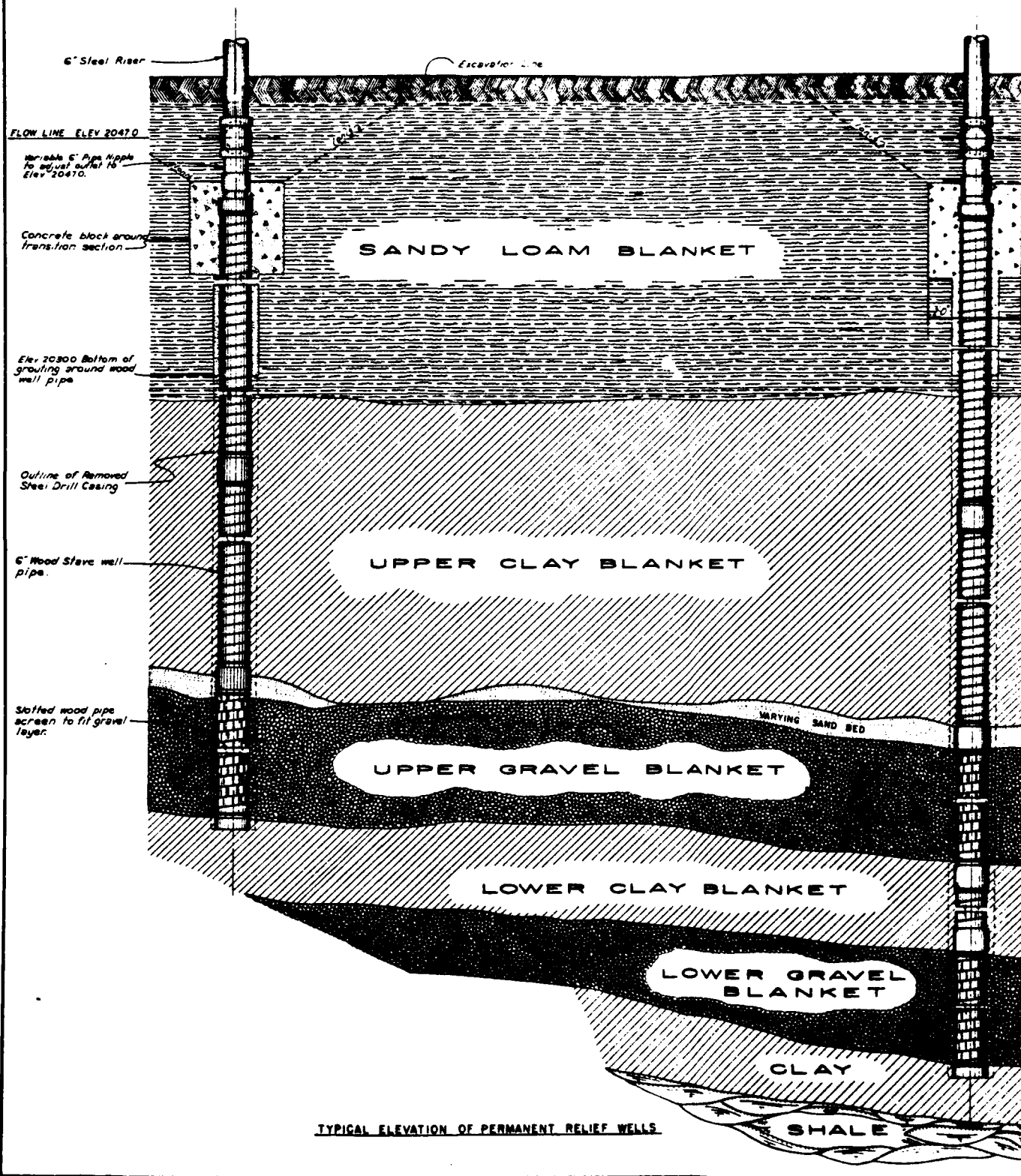


194 195 196 197 198 U. S. ARMY ENGINEER DISTRICT, OMAHA BORDS OF ENGINEERS OMAHA, NEBRASKA	
DESIGNED BY DRAWN BY CHECKED BY APPROVED BY	MISSOURI RIVER FORT PECK LAKE, MONTANA UNDERSEEPAGE STUDIES RIGHT ABUTMENT PIERS "A" FAULT INVESTIGATION
DATE SCALE AS SHOWN SHEET NO.	DATE SCALE AS SHOWN SHEET NO.

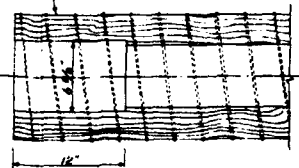
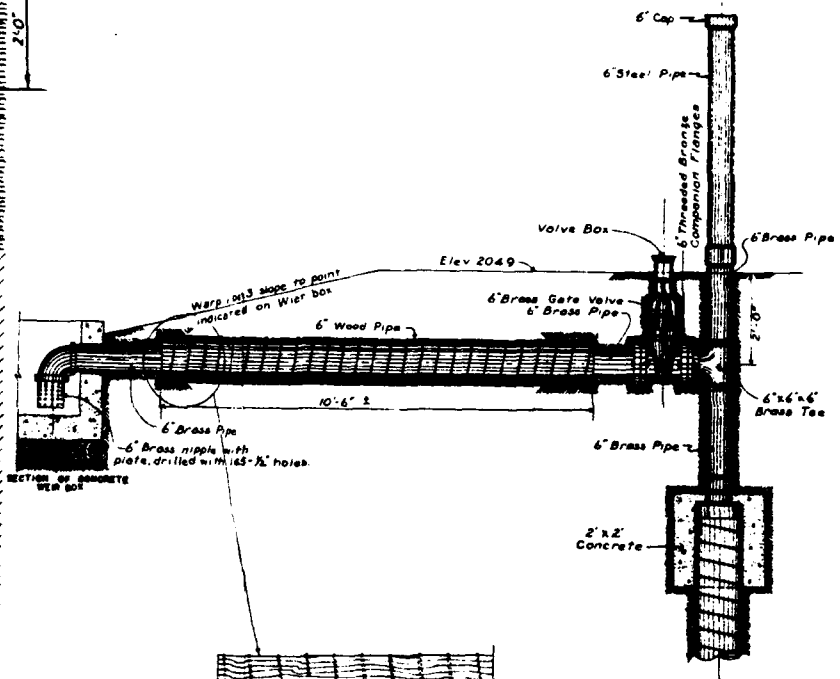
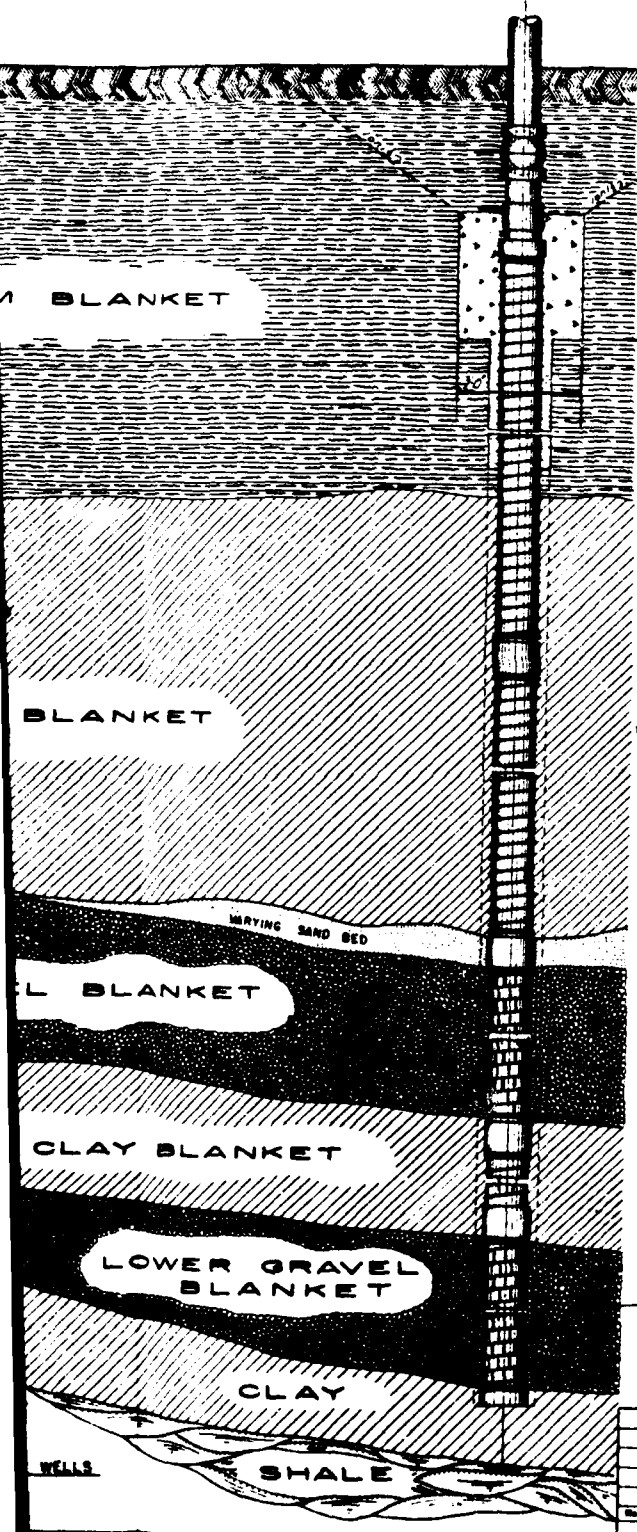
THIS DRAWING HAS BEEN REDUCED TO
 THREE-FOURTHS THE ORIGINAL SCALE.

TYPICAL WELL INSTALLATION
TAPPING UPPER GRAVEL BLANKET ONLY

TYPICAL WELL INSTALLATION
TAPPING BOTH UPPER
GRAVEL BLANKETS



TYPICAL WELL INSTALLATION
TAPPING BOTH UPPER AND LOWER
GRAVEL BLANKETS



TYPICAL RELIEF WELL DISCHARGE FEATURES

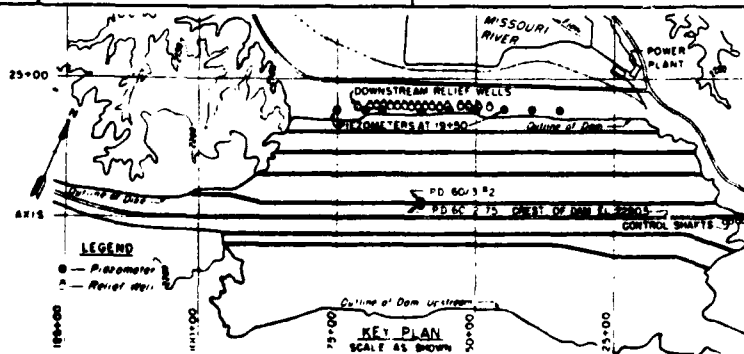
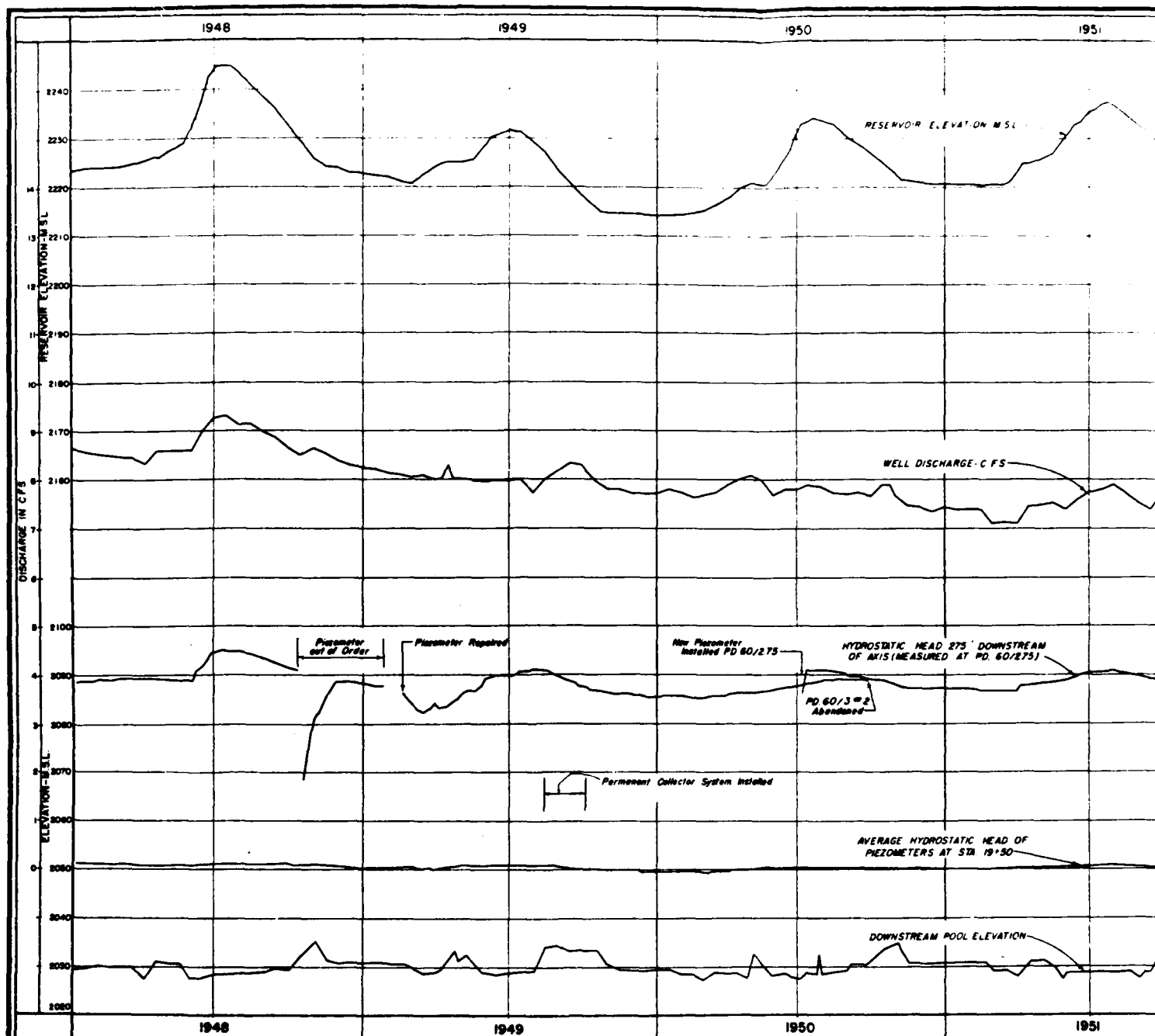
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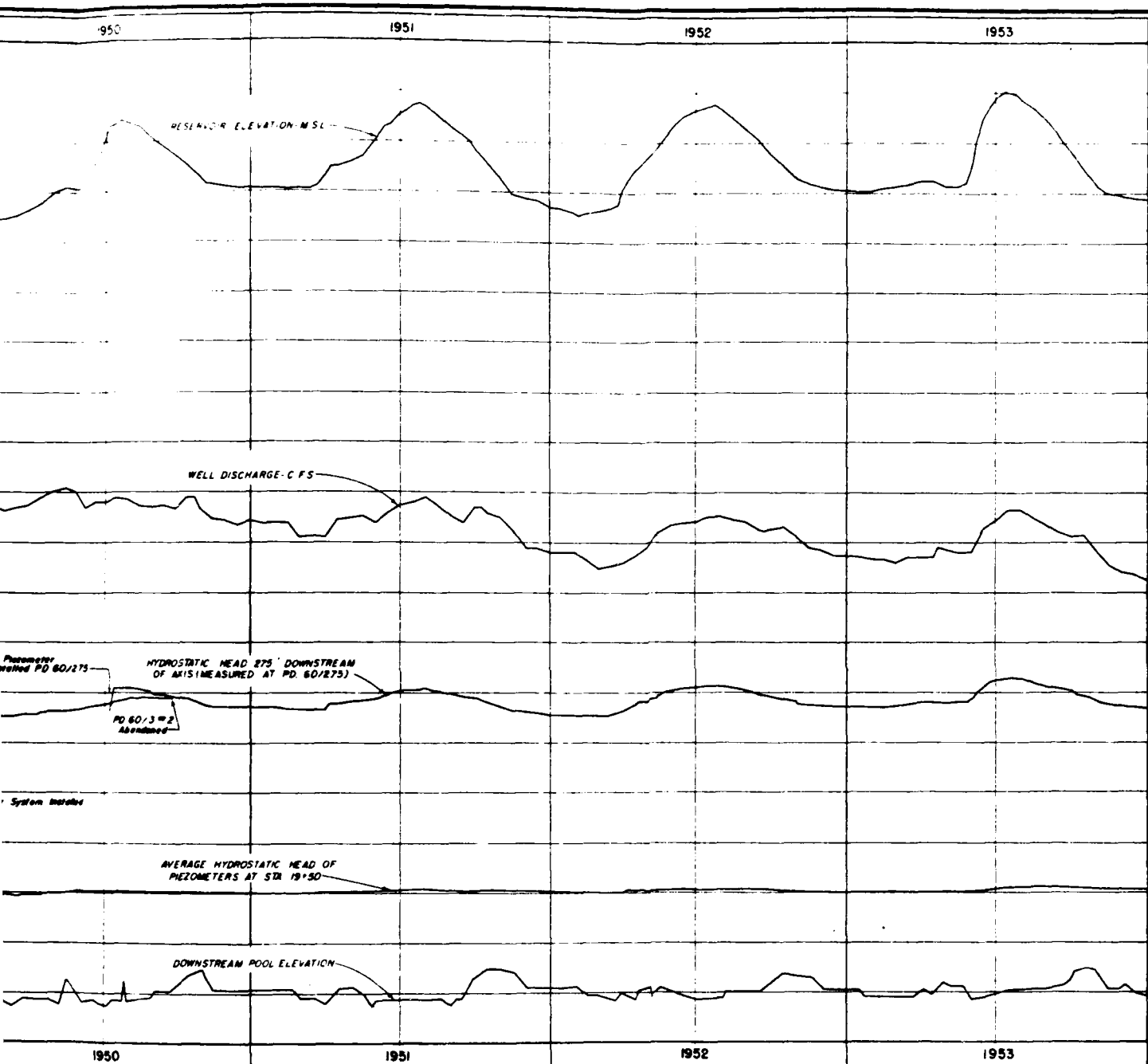
MISSOURI RIVER IMPROVEMENT			
FORT PECK DAM			
PERMANENT WELL RELIEF SYSTEM			
TYPICAL WELL INSTALLATIONS			
IN SHEETS	NO SCALE	SHEET NO	
U.S. ENGINEER OFFICE, FORT PECK, MONTANA			
DATE		BY	
6296.97-1-74			

CONSTRUCTION FOUNDATION REPORT

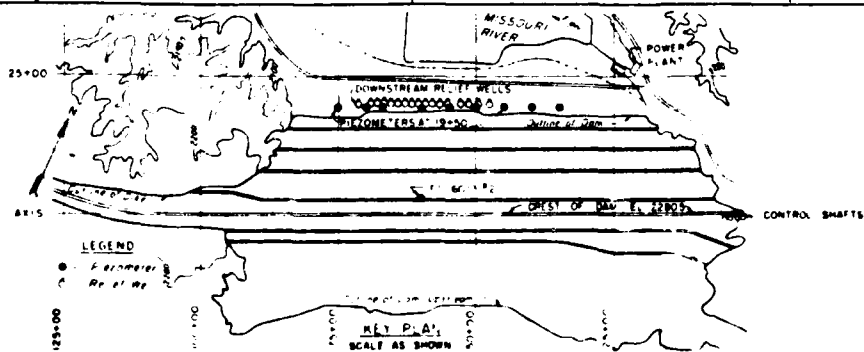
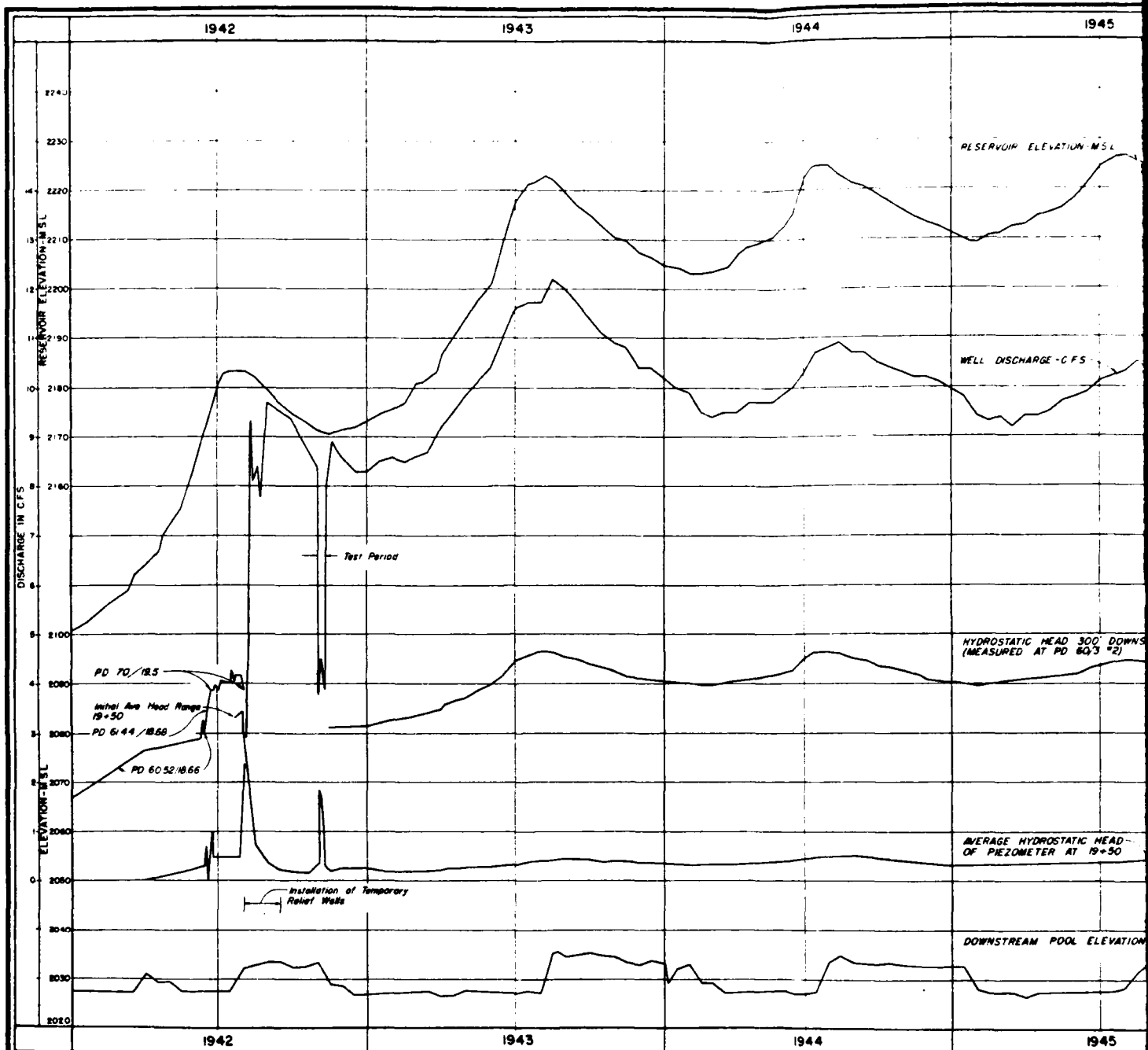
PLATE 64

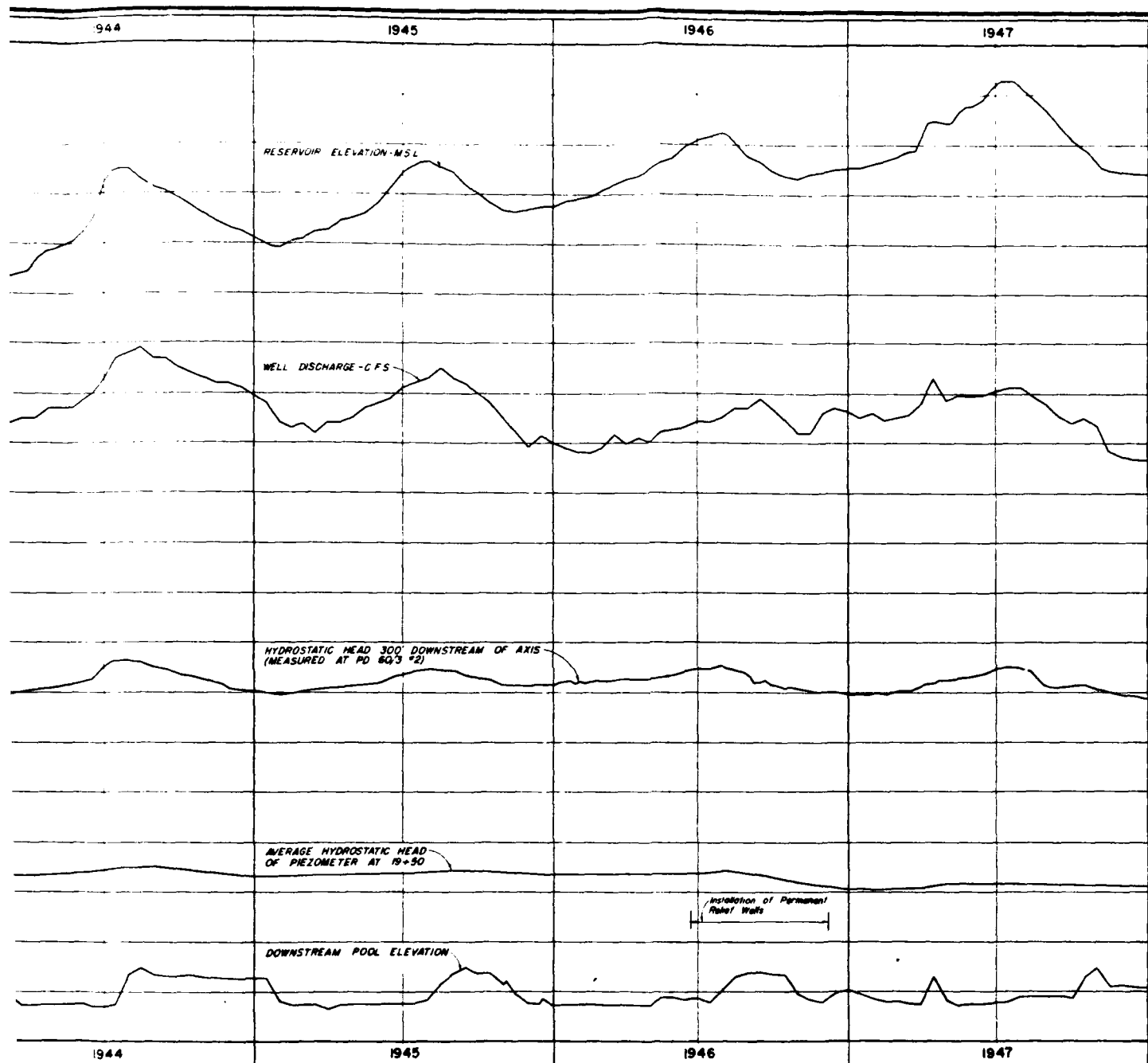
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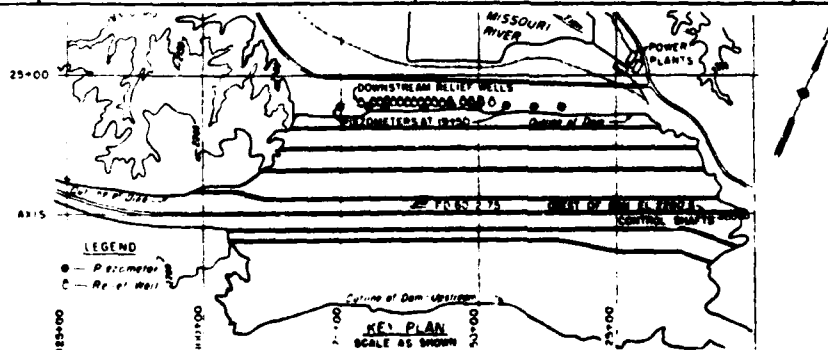
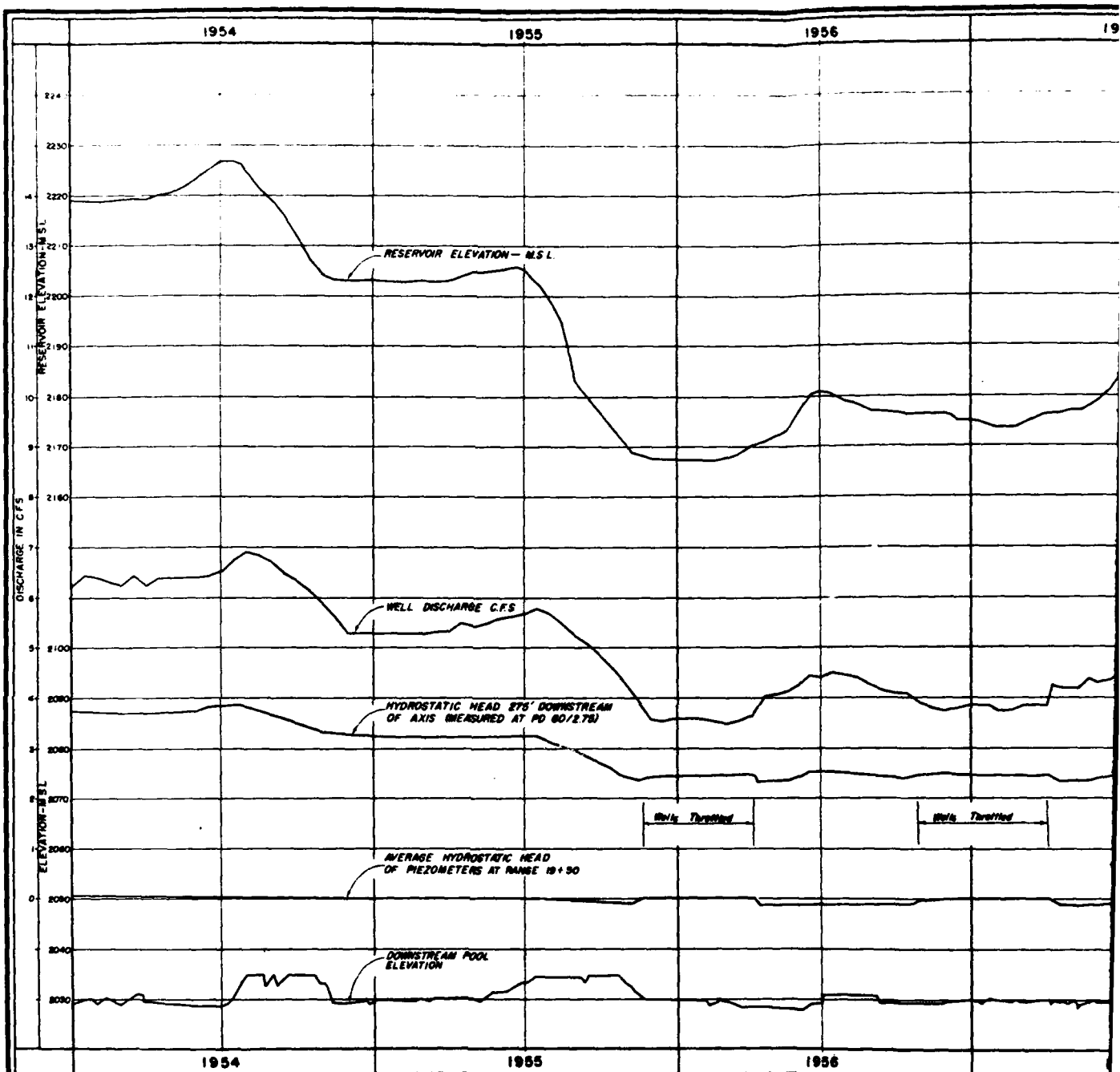
CORPS OF ENGINEERS U. S. ARMY OFFICE OF THE DISTRICT ENGINEER BARRACKS DISTRICT ST. LOUIS, MO.	
MISSOURI RIVER FORT PECK DAM SUMMARY OF HYDRAULIC DATA DOWNSTREAM PRESSURE RELIEF WELL SYSTEM 1948-1953	
DATE: JUNE 1957	BY: [Signature]
PROJECT: [Blank]	REPORT NUMBER: 6296 97-1-102

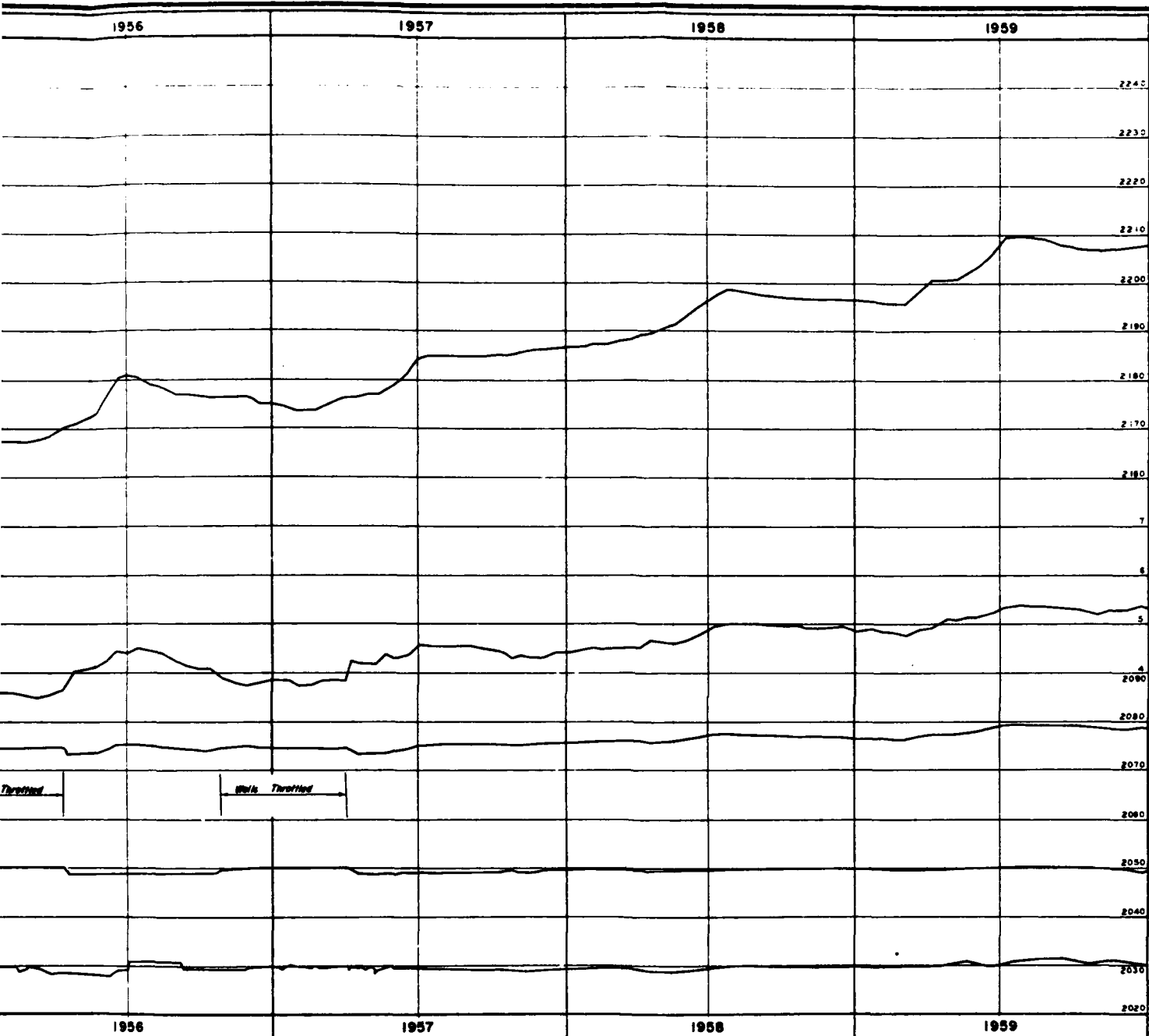




THIS DRAWING HAS BEEN REPRODUCED TO
 THREE TIMES THE ORIGINAL SCALE

CORPS OF ENGINEERS, U. S. ARMY OFFICE OF THE DISTRICT ENGINEER ST. LOUIS DISTRICT ST. LOUIS, MO.	
MISSOURI RIVER FORT PECK DAM	
SUMMARY OF HYDRAULIC DATA DOWNSTREAM PRESSURE RELIEF WELL SYSTEM 1942-1947	
DATE: JUNE 1957	BY: AS SHOWN
8296 97-1-101	





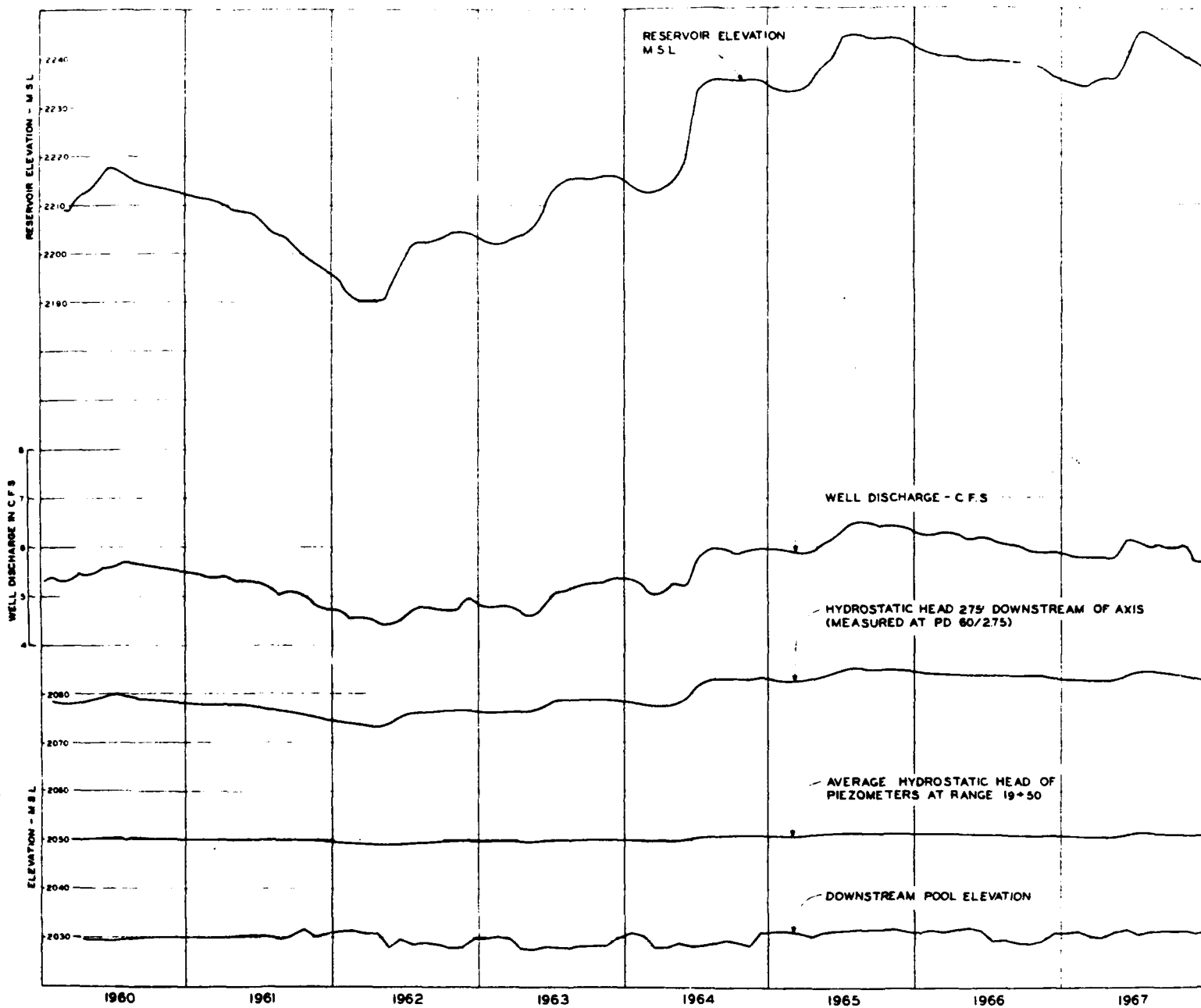
THIS DRAWING HAS BEEN ADJUSTED TO
TAPER-TOGETHER THE ORIGINAL SCALE.

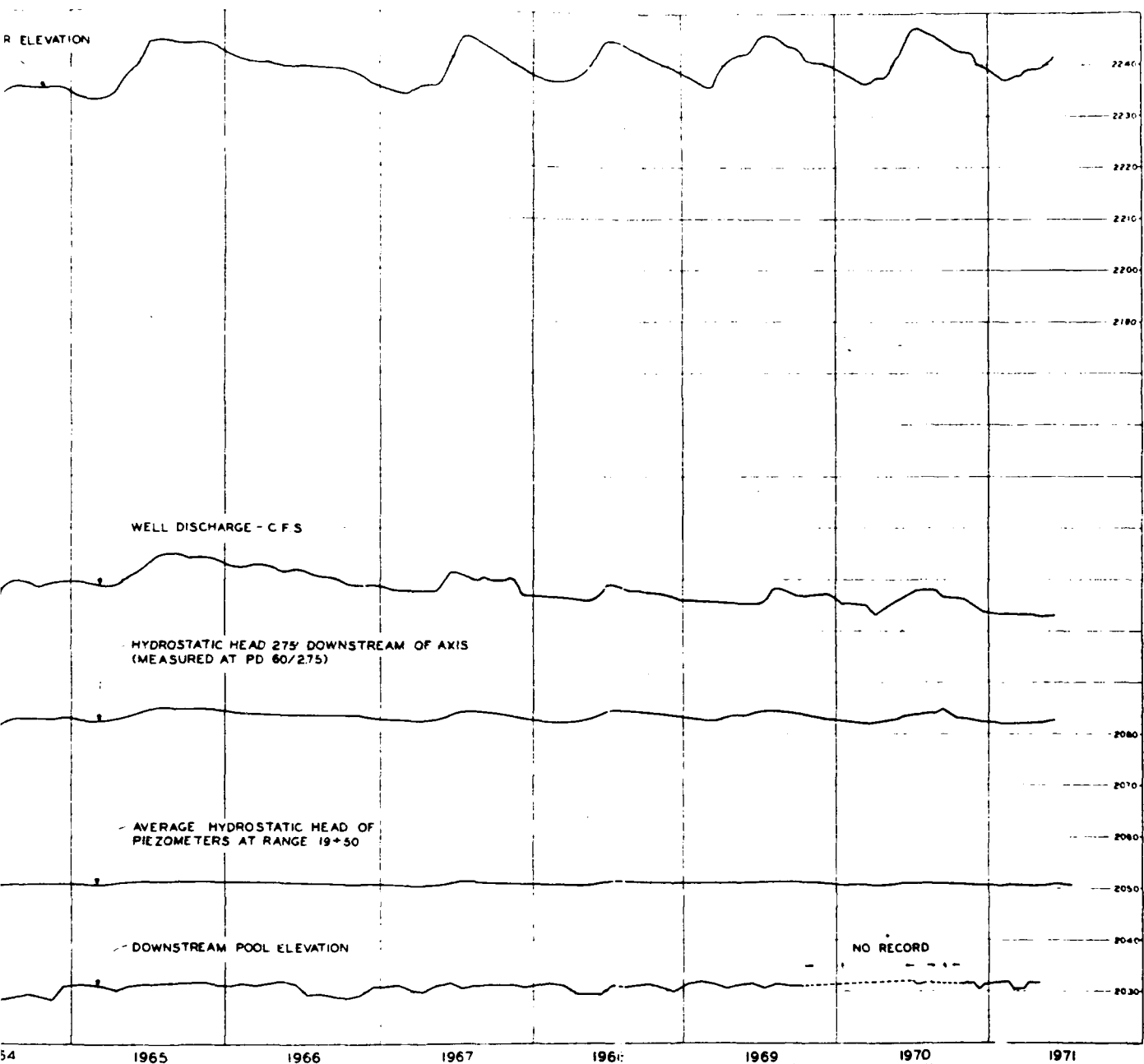
DATE	BY	REVISION	BY	DATE
CORPS OF ENGINEERS, U. S. ARMY OFFICE OF THE DISTRICT ENGINEER ST. LOUIS DISTRICT ST. LOUIS, MO.				
MISSOURI RIVER FORT PECK DAM SUMMARY OF HYDRAULIC DATA DOWNSTREAM PRESSURE RELIEF WELL SYSTEM 1954-1959				
DATE: JUNE 1957			BY: J. B. BROWN	
DRAWN BY: J. B. BROWN			CHECKED BY: J. B. BROWN	
PROJECT NO. 6296 87-1-103			SHEET NO. 1	

CONSTRUCTION FOUNDATION REPORT

PLATE 67

2



[illegible]

THIS DRAWING HAS BEEN REDUCED TO
THREE-EIGHTHS THE ORIGINAL SCALE.

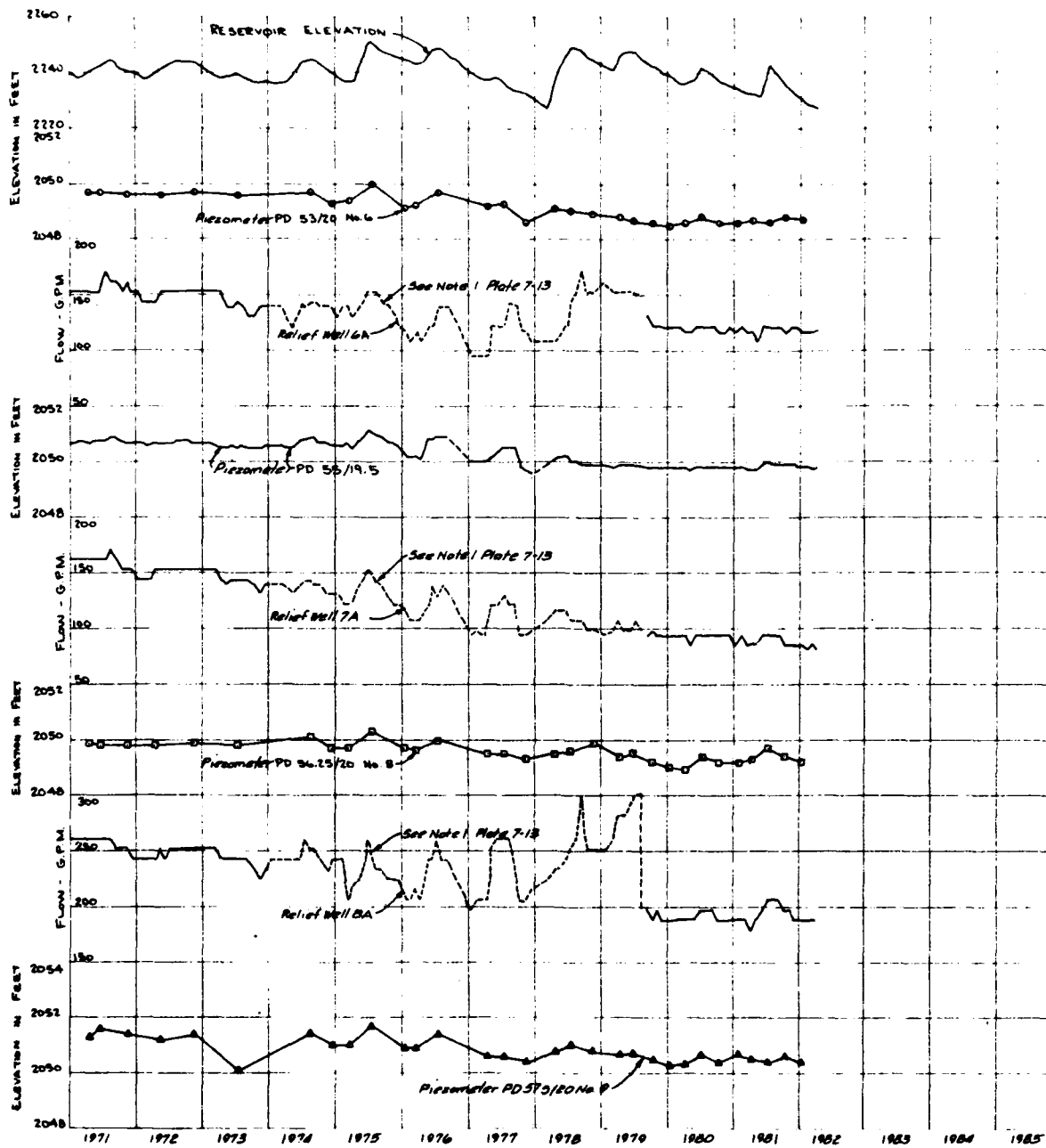
DATE	DESCRIPTION	GRADE	APPROVAL		
DIVISION					
U. S. ARMY ENGINEER DISTRICT, OMAHA GROUP OF ENGINEERS OMAHA, NEBRASKA					
DESIGNED BY:	MISSOURI RIVER FORT PECK LAKE MONTANA SUMMARY OF HYDRAULIC DATA FOR DOWNSTREAM PRESSURE RELIEF WELL SYSTEM, 1971 - 1982 ISTA. 45-00 - 52-00				
DESIGN BY:					
CHECKED BY:					
APPROVED BY:					
DATE	DESIGN	APPROVAL		DATE	
DATE	DESIGN	APPROVAL		DATE	
DATE	DESIGN	APPROVAL		DATE	
DATE	DESIGN	APPROVAL		DATE	



THIS PLAN ACCOMPANIES CONTRACT NO. _____
MODIFICATION NO. _____

CONSTRUCTION FOUNDATION REPORT

PLATE 69



1982 1983 1984 1985

THIS DRAWING HAS BEEN REDUCED TO
THREE-FOURTHS THE ORIGINAL SCALE.



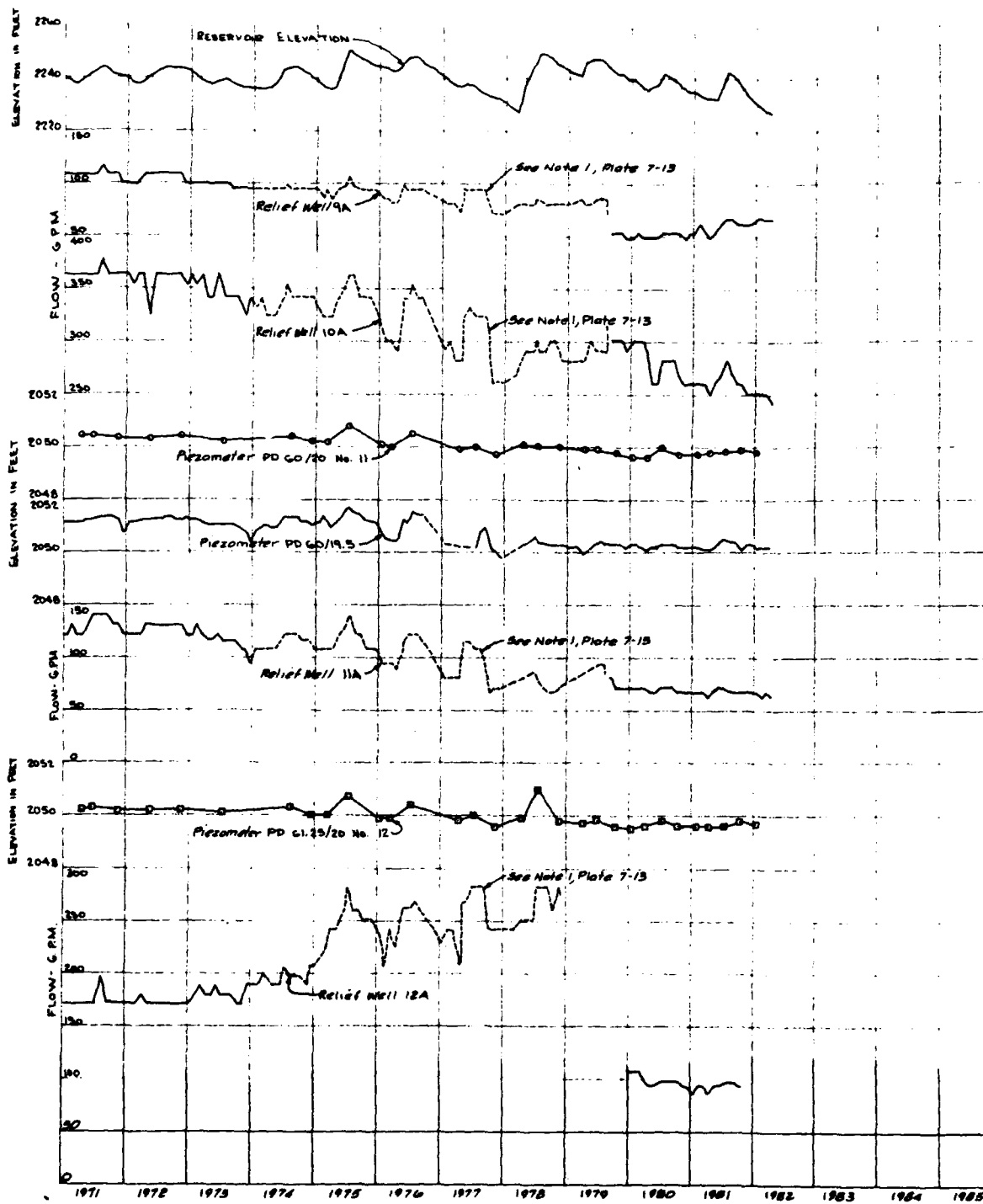
THIS PLAN ASSUMES CONTRACT NO.
MODIFICATION NO.

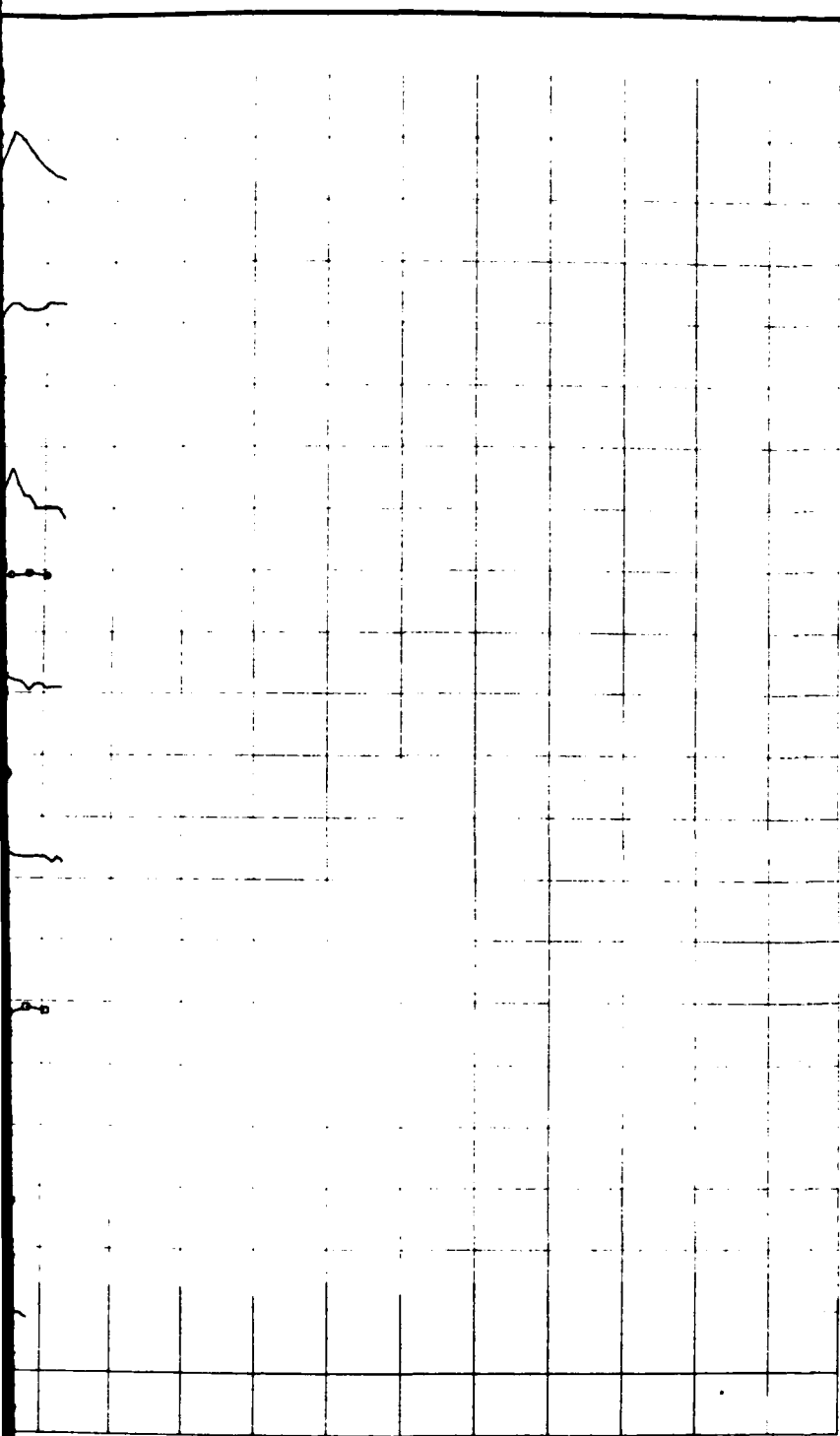
DIVISION		DATE		APPROVED	
U. S. ARMY ENGINEER DISTRICT, OMAHA GROUP OF ENGINEERS OMAHA, NEBRASKA					
DESIGNED BY		MISSOURI RIVER FORT PECK LAKE MONTANA SUMMARY OF HYDRAULIC DATA FOR DOWNSTREAM PRESSURE RELIEF WELL SYSTEM, 1971 - 1982			
CHECKED BY		(STA. 52+00 - 58+00)			
DRAWN BY		DATE			
SCALE		SHEET NO.			
PROJECT		SHEET NO.			
APP'D		SHEET NO.			

CONSTRUCTION FOUNDATION REPORT

PLATE 70







THIS DRAWING HAS BEEN REDUCED TO
THREE-EIGHTHS THE ORIGINAL SCALE.

DATE		DESCRIPTION		REVISION	APPROVED
DIVISION					
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA					
DESIGNED BY		MISSOURI RIVER			
CHECKED BY		PORT PECK LAKE MONTANA			
DRAWN BY		SUMMARY OF HYDRAULIC DATA FOR			
APPROVED BY		DOWNSTREAM PRESSURE RELIEF WELL SYSTEM, 1971 - 1982			
DATE		1971 - 1982			
SCALE		1:5000			
SHEET NO.		1 OF 1			
PROJECT NO.		157A, 57-80 - 62-80			
DRAWING NO.		157A, 57-80 - 62-80			
REVISION		157A, 57-80 - 62-80			

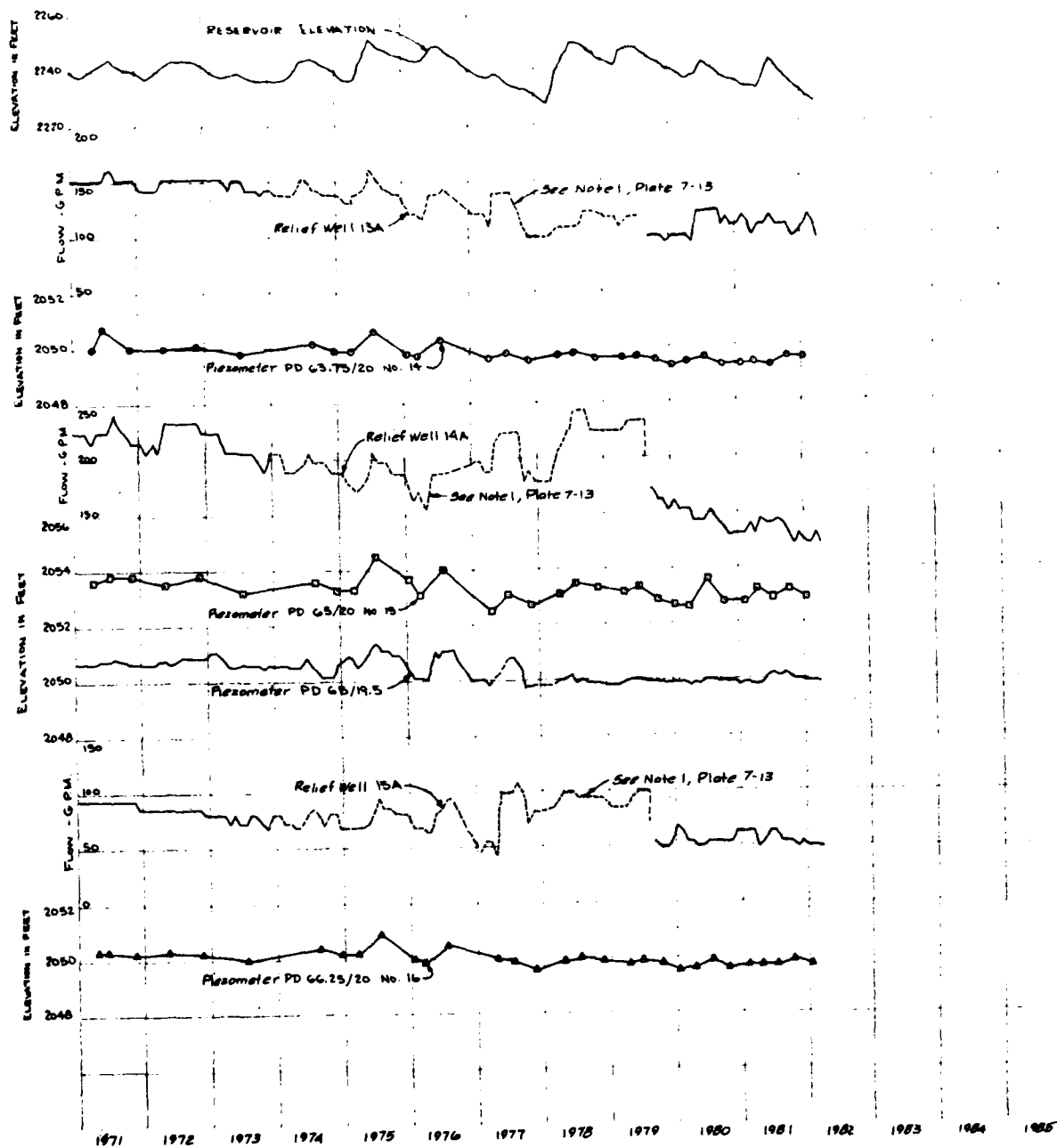


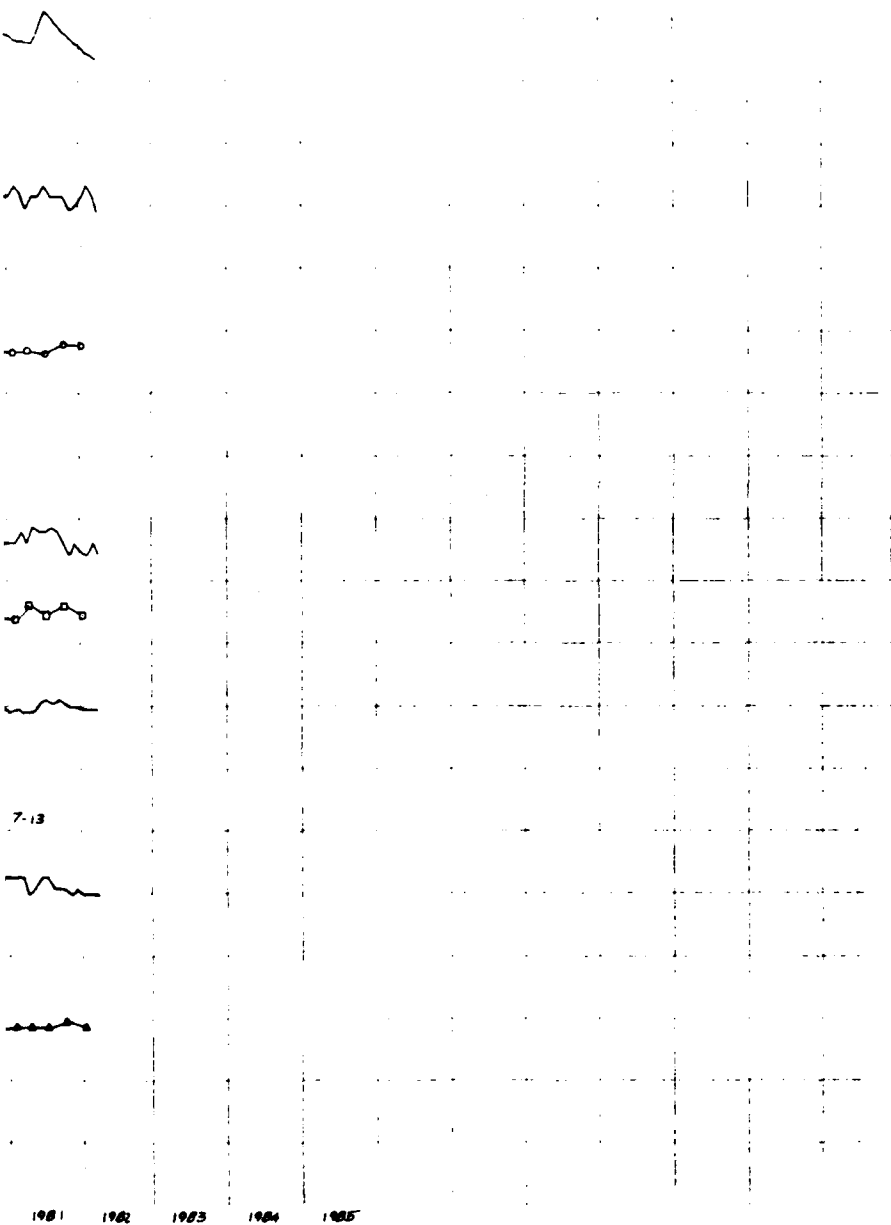
THIS PLAN ACCOMPANIES CONSTRUCTION FOR
REGISTRATION NO.

CONSTRUCTION FOUNDATION REPORT

PLATE 71

2





THIS DRAWING HAS BEEN REDUCED TO
THREE-FIFTHS THE ORIGINAL SCALE.

[illegible]

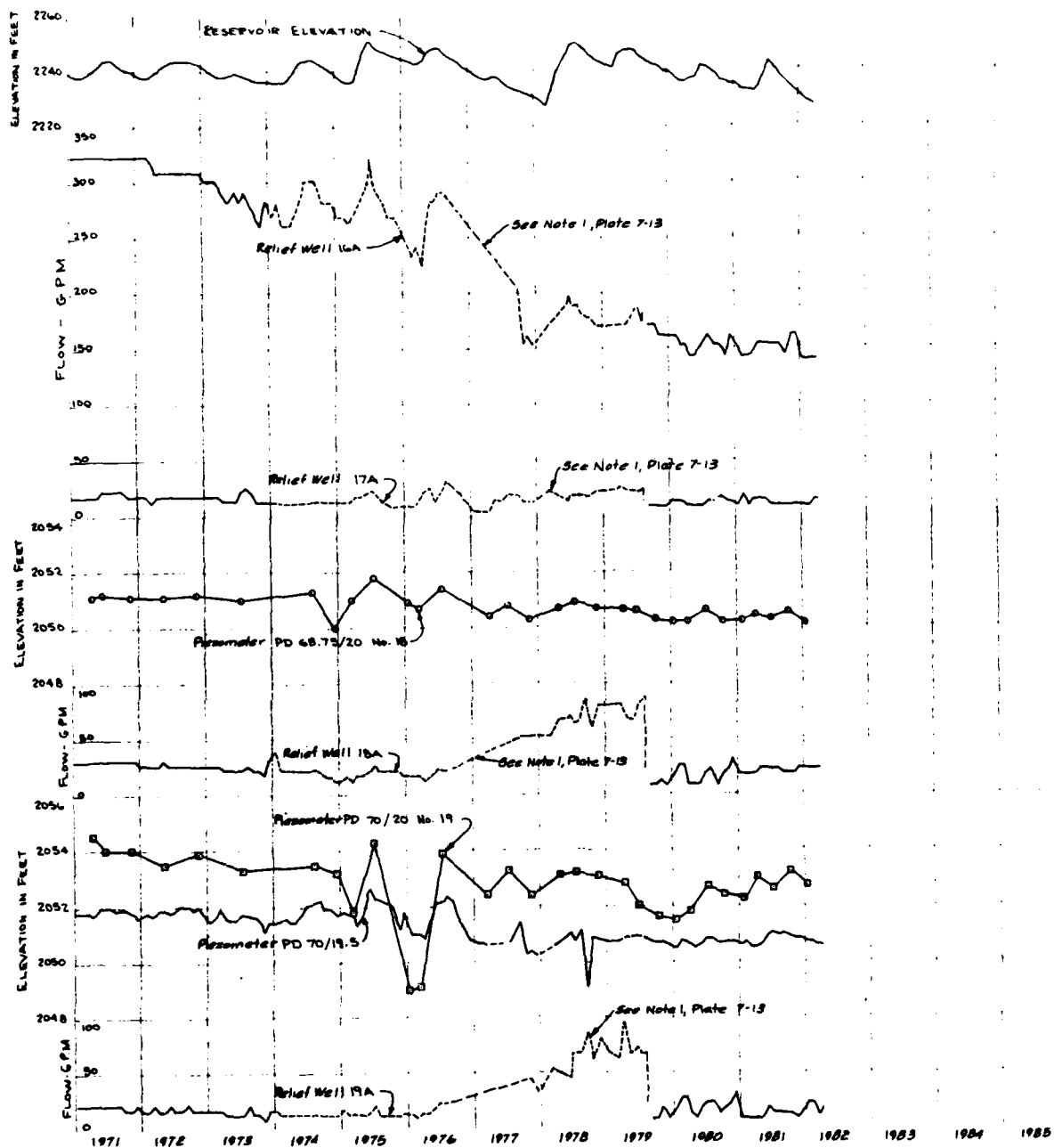
THIS PLAN REPRESENTS CONTRAST IN
 REPRODUCTION IN

Fig. 3. L. gossypii

CONSTRUCTION FOUNDATION REPORT

PLATE 72

2



1982 1983 1984 1985

THIS DRAWING HAS BEEN REDUCED TO
THREE-EIGHTH THE ORIGINAL SCALE.



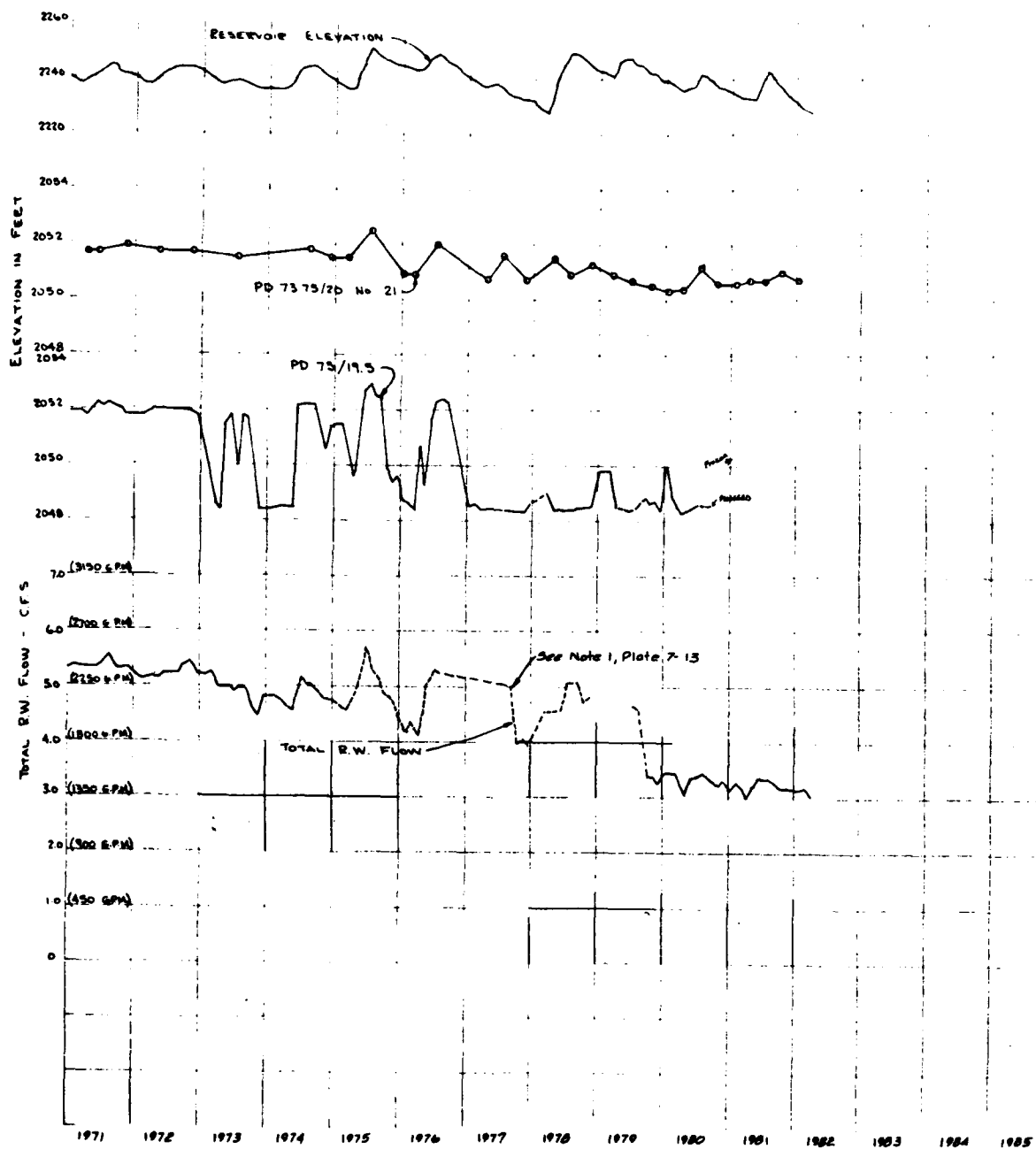
THIS PLAN ASSUMES CONTRACT NO.
VERIFICATION NO.

DESIGNED BY		CHECKED BY		APPROVED BY	
DATE		DATE		DATE	
DIVISION					
U. S. ARMY ENGINEER DISTRICT, OMAHA GROUP OF ENGINEERS OMAHA, NEBRASKA					
PROJECT NO.		MISSOURI RIVER PORT PECK LAKE MONTANA SUMMARY OF HYDRAULIC DATA FOR DOWNSTREAM PRESSURE RELIEF WELL SYSTEM, 1971 - 1982			
DRAWN BY		ISTA, 66-00 - 72-00			
CHECKED BY		DATE			
APPROVED BY		DATE			
DESIGNED BY		DATE			
CHECKED BY		DATE			
APPROVED BY		DATE			

CONSTRUCTION FOUNDATION REPORT

PLATE 73

2



1982 1983 1984 1985

THIS DRAWING HAS BEEN REDUCED TO
THREE-EIGHTHS THE ORIGINAL SCALE.



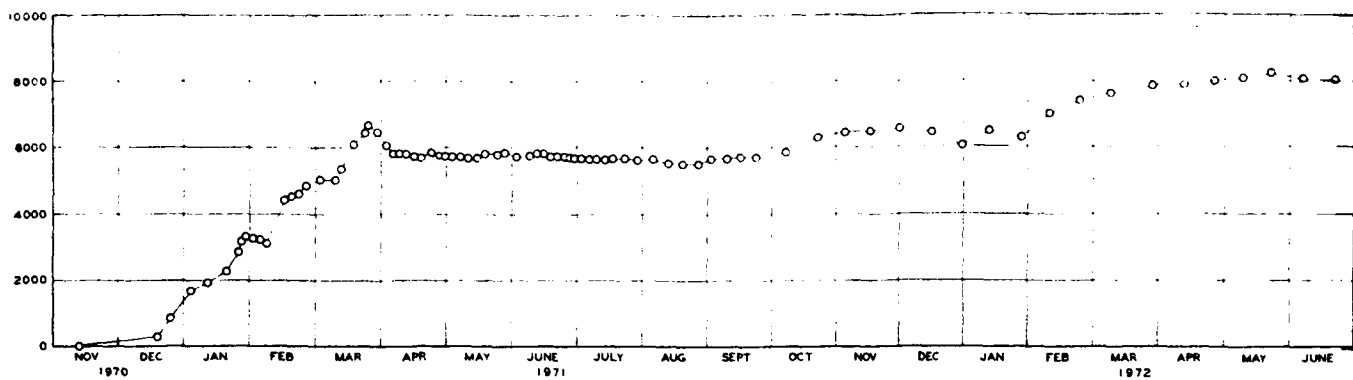
THIS PLAN ACCOMPANIES DRAWING NO.
CONSTRUCTION FND.

DATE	DESCRIPTION	ISSUED	APPROVED
REVISIONS			
U. S. ARMY ENGINEER DISTRICT, OMAHA GROUP OF ENGINEERS OMAHA, NEBRASKA			
DESIGNED BY:	MISSOURI RIVER FORT PECK LAKE MONTANA SUMMARY OF HYDRAULIC DATA FOR DOWNSTREAM PRESSURE RELIEF WELL SYSTEM, 1971 - 1982		
DRAWN BY:	15A, 72+00 - 74+00		
CHECKED BY:	DATE		
APPROVED BY:	DATE		
THIS PLAN ACCOMPANIES DRAWING NO.		CONSTRUCTION FND.	

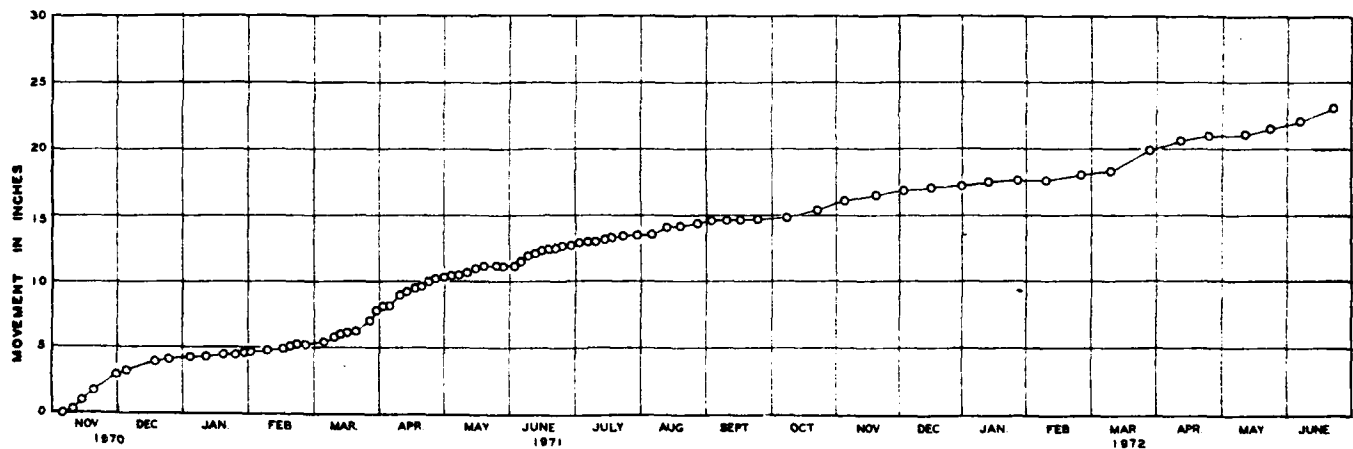
CONSTRUCTION FOUNDATION REPORT

PLATE 74

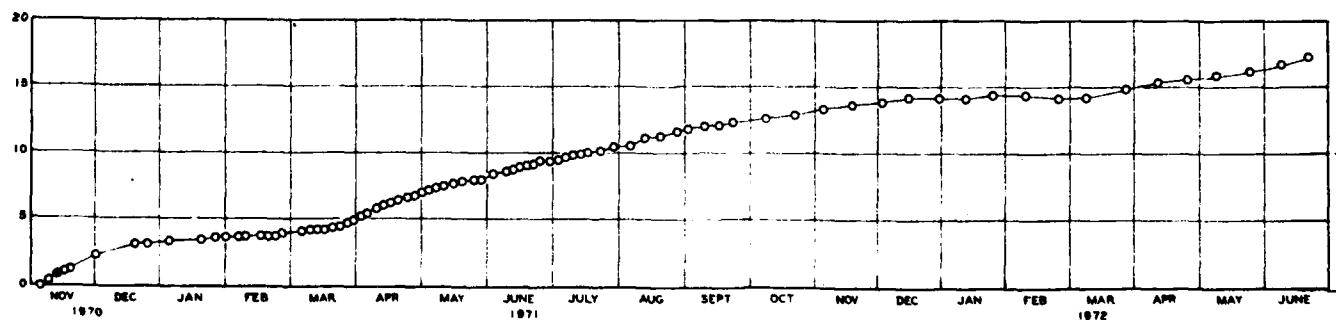
2



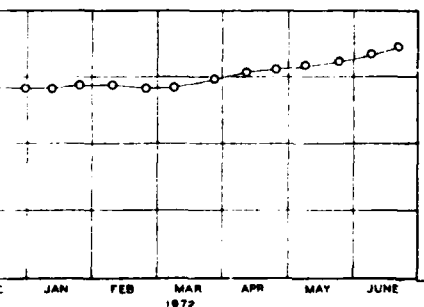
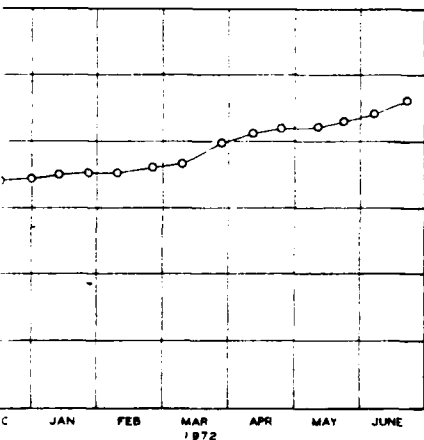
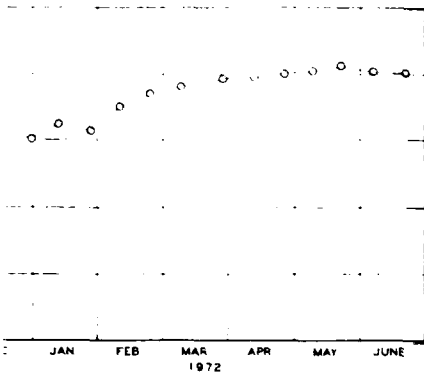
DIAL GAGE



GAGE 1



GAGE 2



THIS DRAWING HAS BEEN REDUCED TO
THREE EIGHTHS THE ORIGINAL SCALE



THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.

DATE		REVISIONS		DATE	APPROVED
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA					
DESIGNED BY: R. J. M.	MISSOURI RIVER				
DRAWN BY: M. E. B.	FORT PECK LAKE, MONTANA				
CHECKED BY: C. J. J.	POWERHOUSE SLOPE EXCAVATION				
APPROVED BY: <i>[Signature]</i>	SLIDE MOVEMENT OBSERVATIONS				
DATE: <i>[Signature]</i>	DIAL & WIRE GAGES - SHEET 1				
DATE: <i>[Signature]</i>	DATE: <i>[Signature]</i>	DATE: <i>[Signature]</i>	DATE: <i>[Signature]</i>	DATE: <i>[Signature]</i>	DATE: <i>[Signature]</i>
DATE: <i>[Signature]</i>	DATE: <i>[Signature]</i>	DATE: <i>[Signature]</i>	DATE: <i>[Signature]</i>	DATE: <i>[Signature]</i>	DATE: <i>[Signature]</i>

CONSTRUCTION FOUNDATION REPORT PLATE 74A

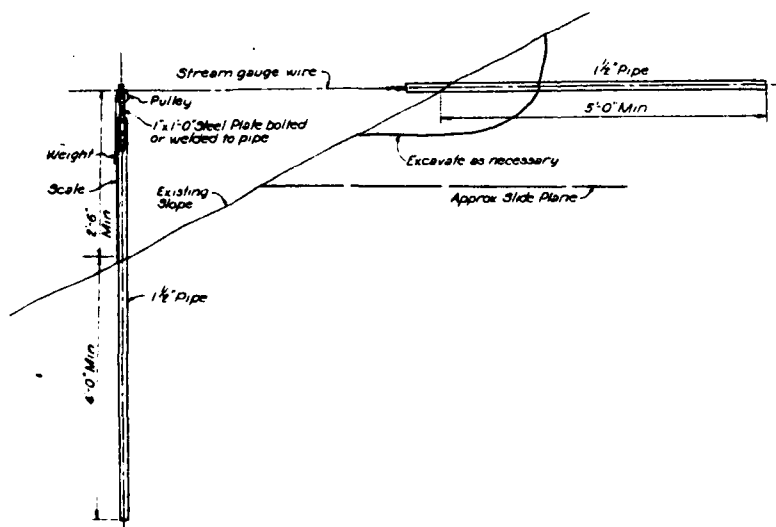
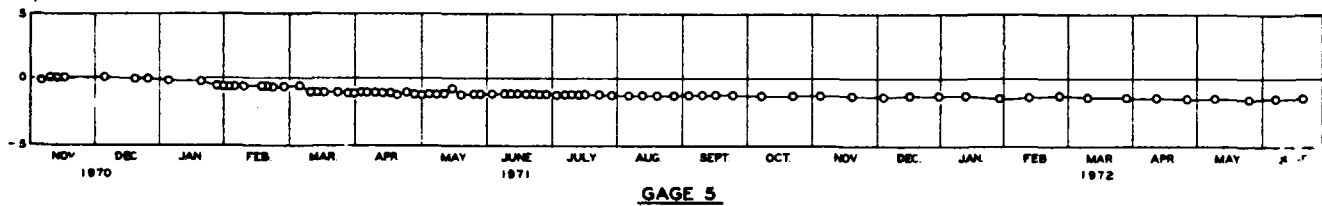
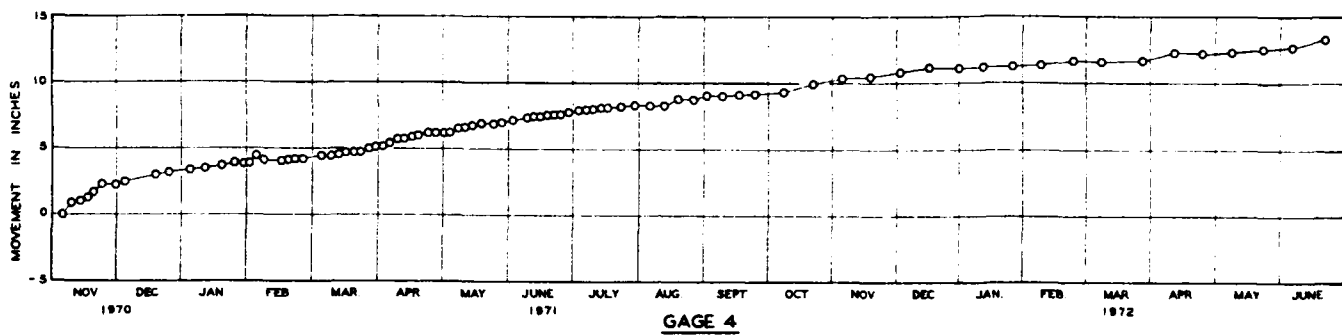
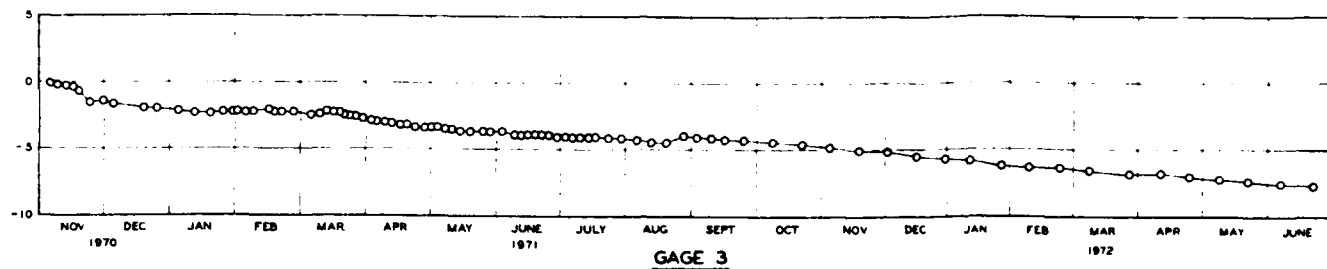
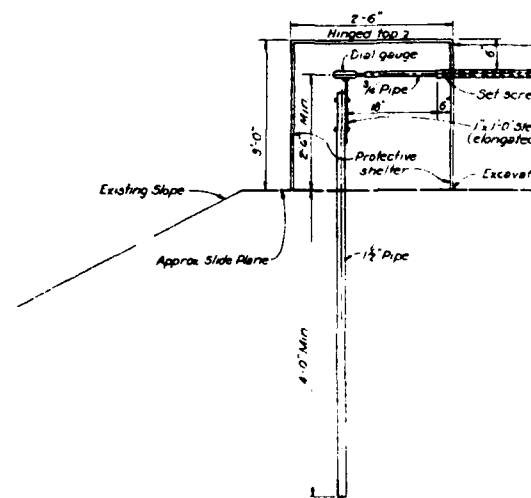


FIGURE NO. 2



FIGURE

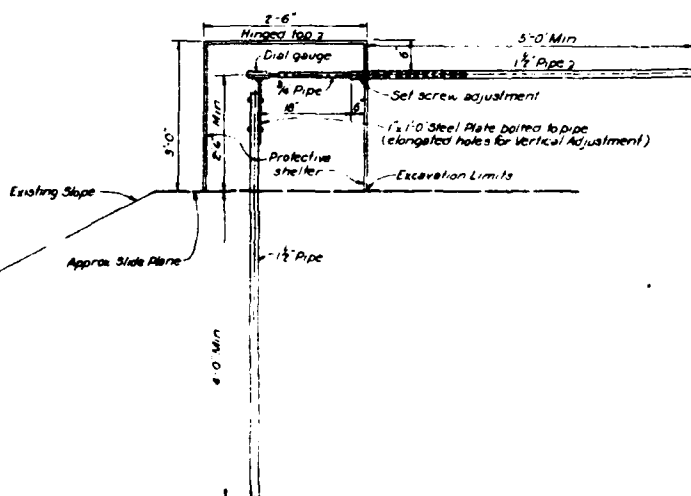
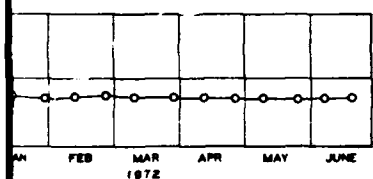
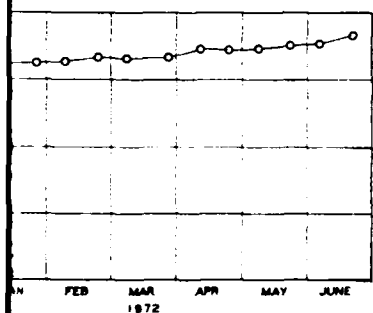
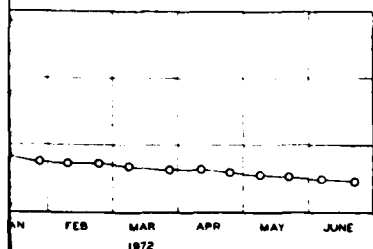


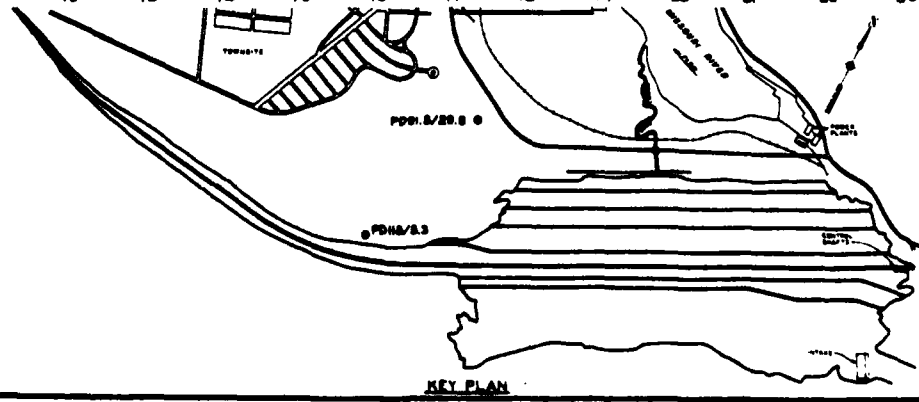
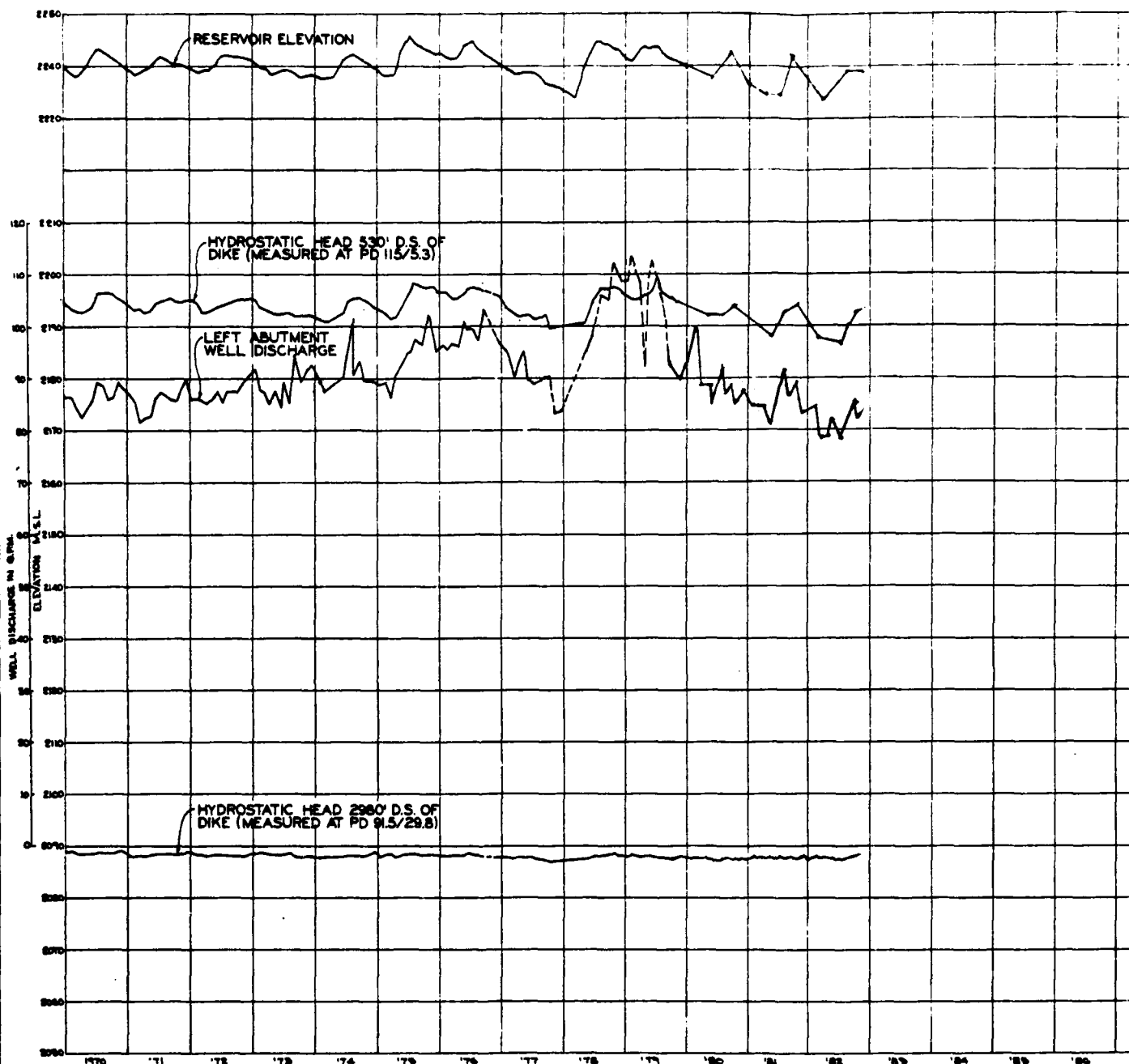
FIGURE NO. 1

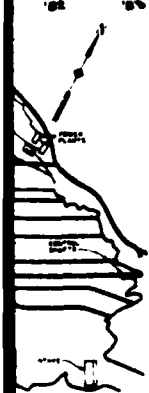
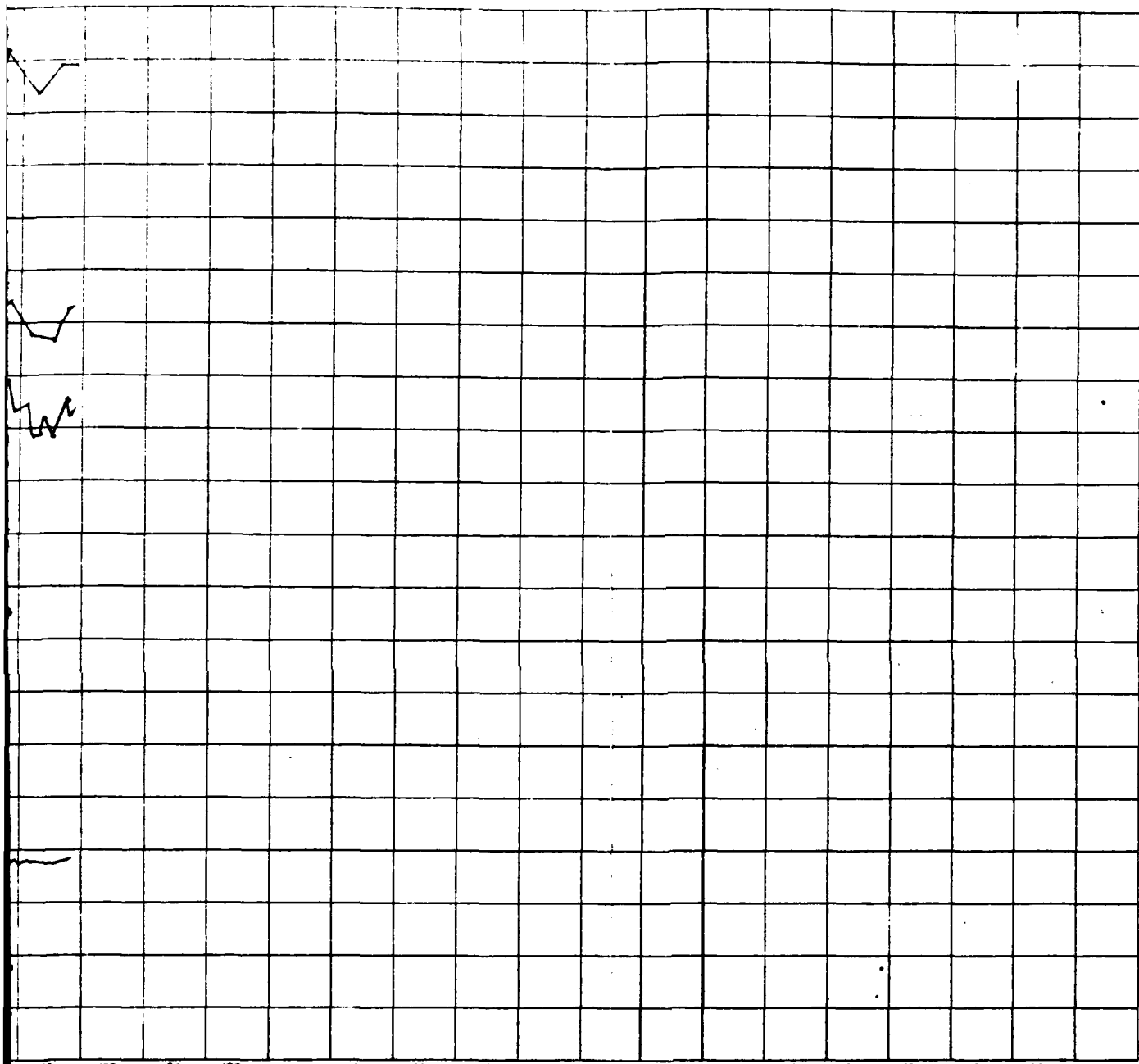
THIS DRAWING HAS BEEN REDUCED TO
THREE EIGHTHS THE ORIGINAL SIZE

REVISIONS		DATE	BY	APPV
U. S. ARMY ENGINEER DISTRICT, OMAHA GROUP OF ENGINEERS OMAHA, NEBRASKA				
MISSOURI RIVER FORT PECK LAKE, MONTANA POWERHOUSE SLOPE EXCAVATION SLIDE MOVEMENT OBSERVATIONS DIAL & WIRE GAGES - SHEET 2				
DESIGNED BY: P. J. M.	CHECKED BY: M. E. B.	DATE: JULY 1972		
DRAWN BY: S. F. L. (Signature)				
APPROVED BY: S. F. L. (Signature)				
SCALE: AS SHOWN				



THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.





THIS DRAWING HAS BEEN REDUCED TO
THREE-EIGHTHS THE ORIGINAL SCALE.



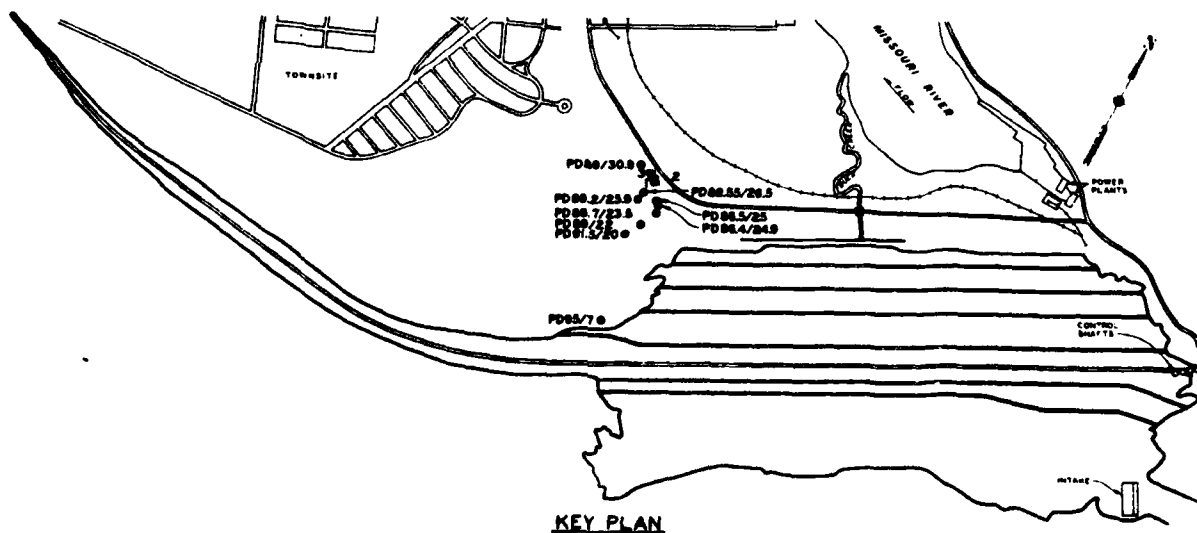
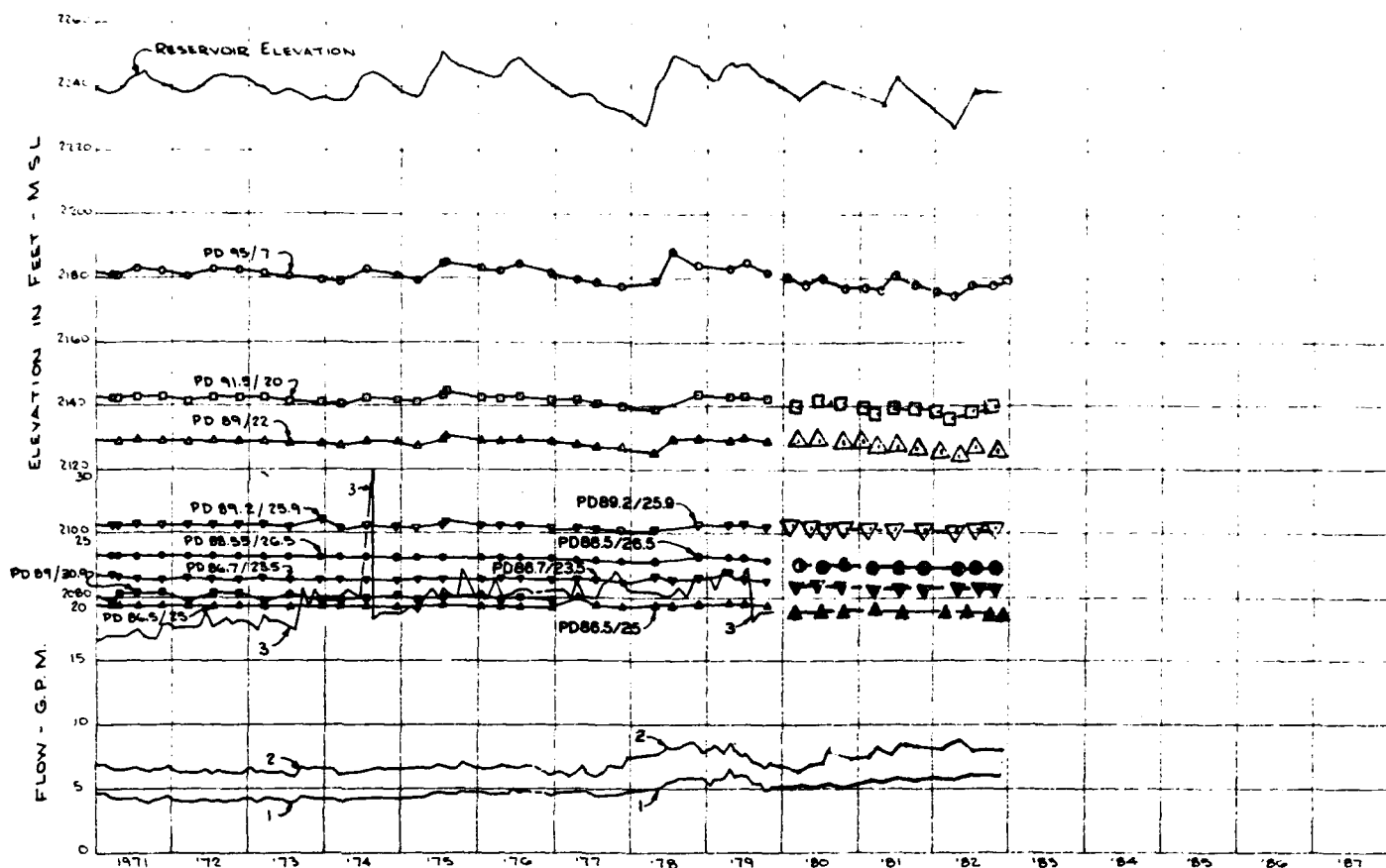
THIS PLAN ACCOMPANIES CONSTRUCTION NO.
CONSTRUCTION NO.

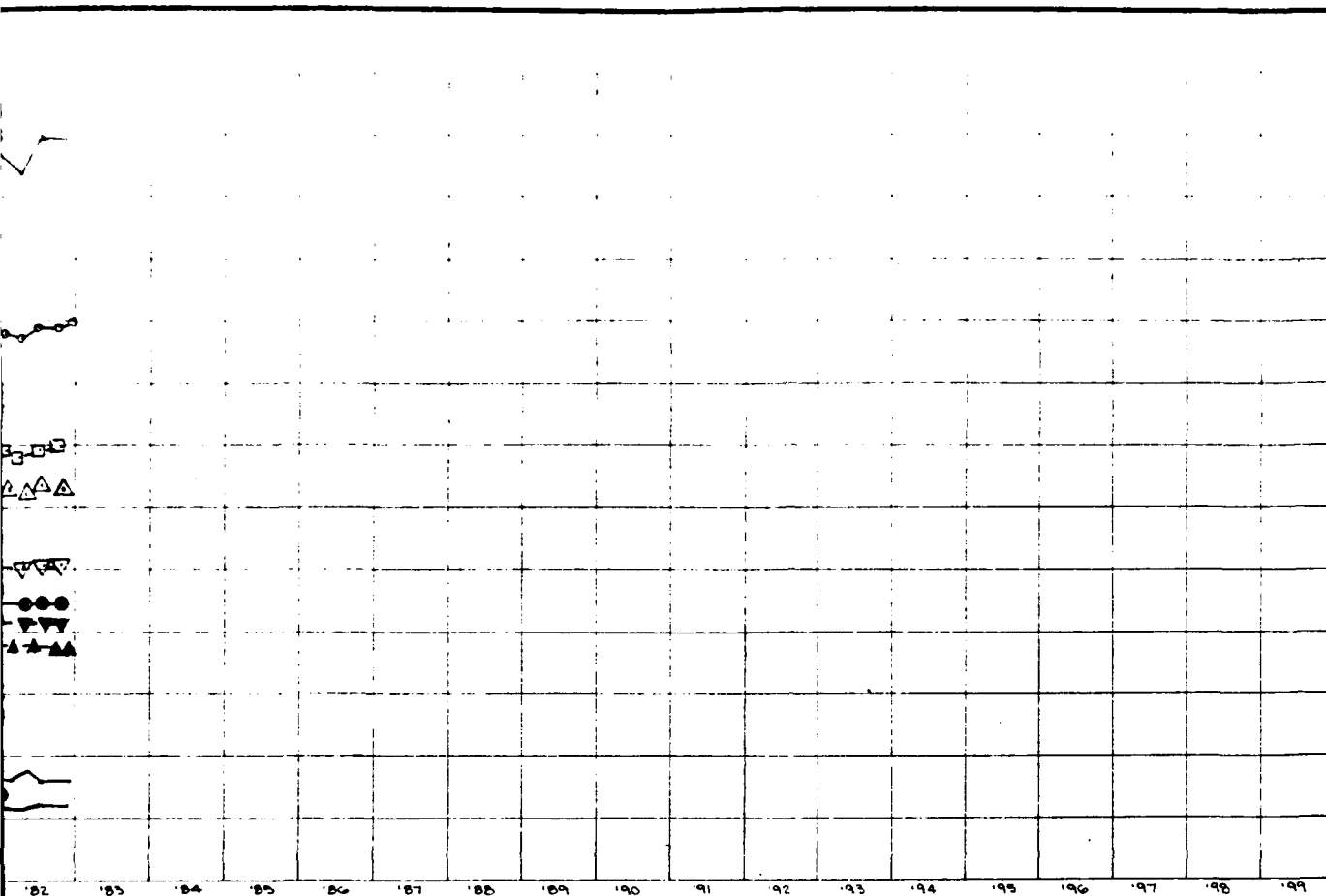
DESIGNED BY: GEA		CHECKED BY: GEA	
DRAWN BY: GEA		APPROVED BY: GEA	
U. S. ARMY ENGINEER DISTRICT, OMAHA GROUP OF ENGINEERS OMAHA, NEBRASKA			
FORT PECK, MONTANA SUMMARY OF HYDRAULIC DATA LEFT ABUTMENT PRESSURE RELIEF WELL SYSTEM 1970 - 1980			
DATE: 1970	SCALE: 1" = 100'	BY: GEA	CHKD: GEA
APPROVED BY: GEA		DATE: 1970	

CONSTRUCTION FOUNDATION REPORT

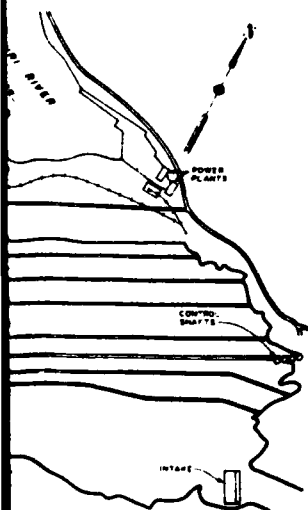
PLATE 75

2





PIEZOMETER TESTS - AUGUST 1977
ALL IN FEET RELATIVE TO MEAN SEA LEVEL



THIS DRAWING HAS BEEN REDUCED TO
THREE-EIGHTS THE ORIGINAL SCALE.



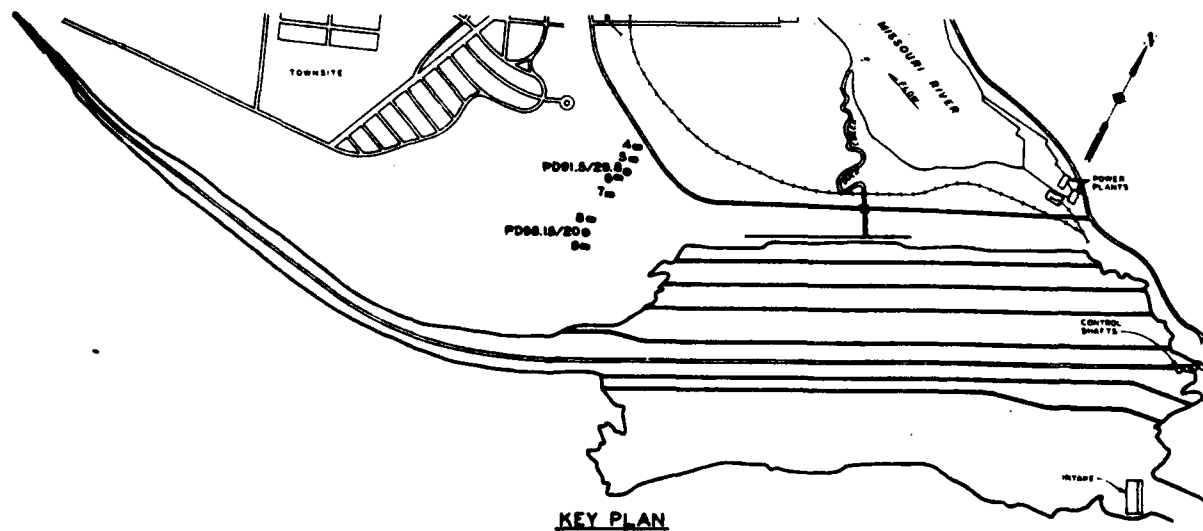
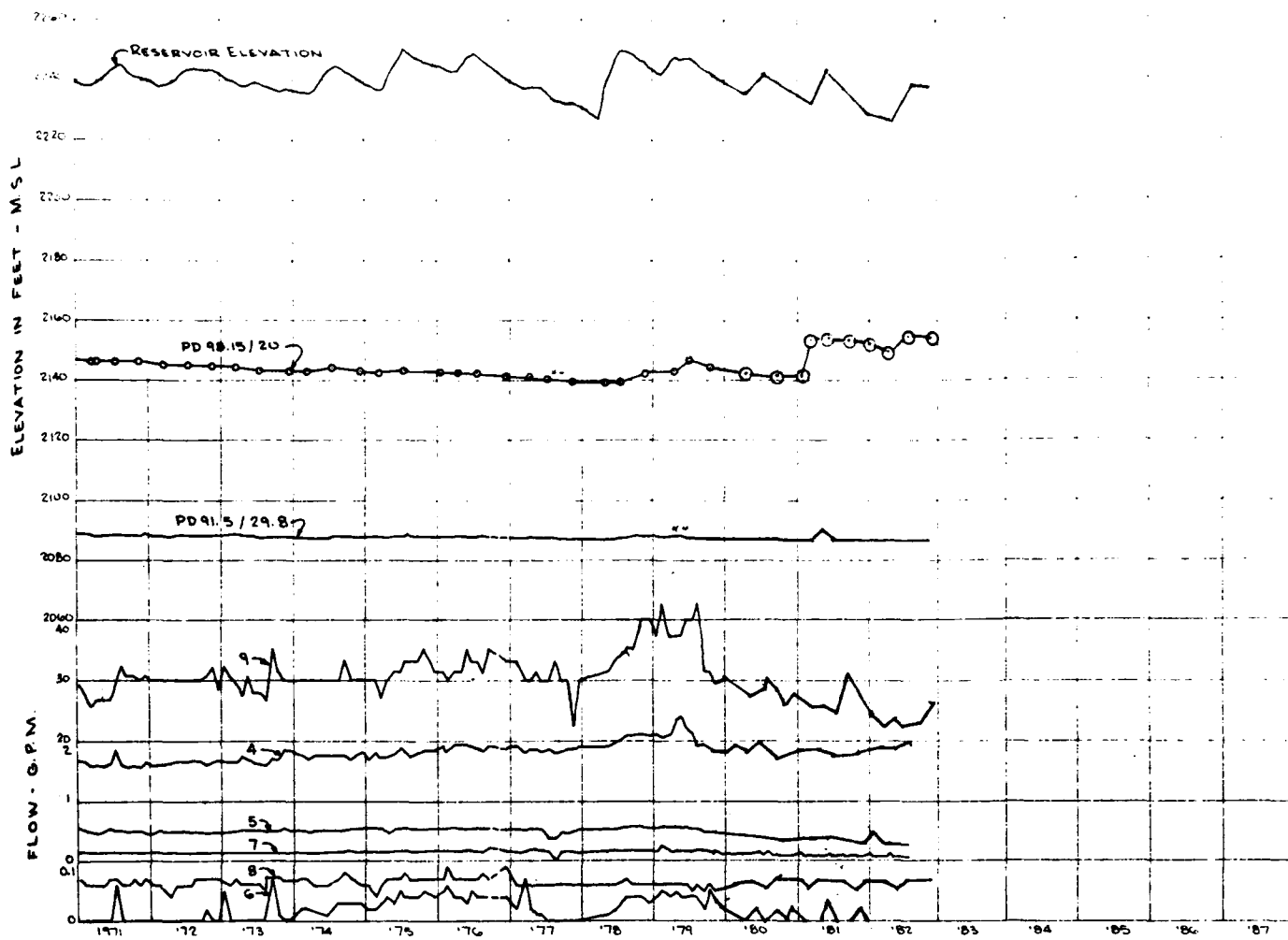
THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.

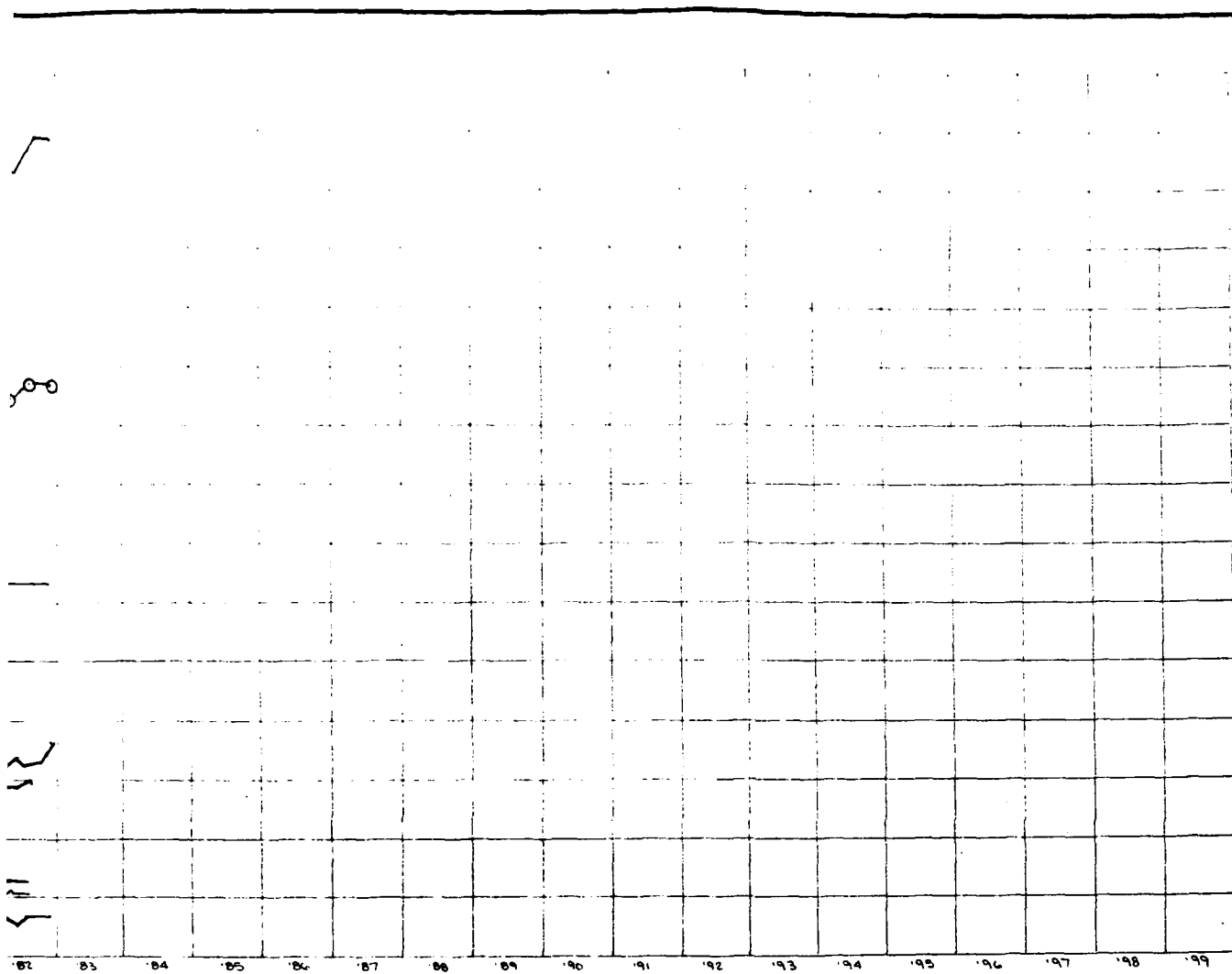
771 See Data P-57... and profile		DATE	APPROVED
DIVISION			
U. S. ARMY ENGINEER DISTRICT, OMAHA GROUP OF ENGINEERS OMAHA, NEBRASKA			
DESIGNED BY:		DATE	
CHECKED BY:		DATE	
APPROVED BY:		DATE	
PROJECT:		DATE	
SHEET NO.		SHEET TOTAL	
SCALE AS SHOWN		SCALE AS SHOWN	
DRAWN BY:		DATE	

CONSTRUCTION FOUNDATION REPORT

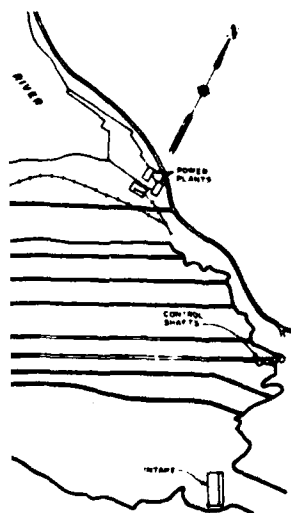
PLATE 76

2





4. THE FOLLOWING INFORMATION IS FOR THE RECORD OF THE PROJECT AND IS NOT TO BE USED FOR IMMEDIATE ACTION. IT HAS AN APPROXIMATE 7-14 DAY TIME LAG.



THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE.



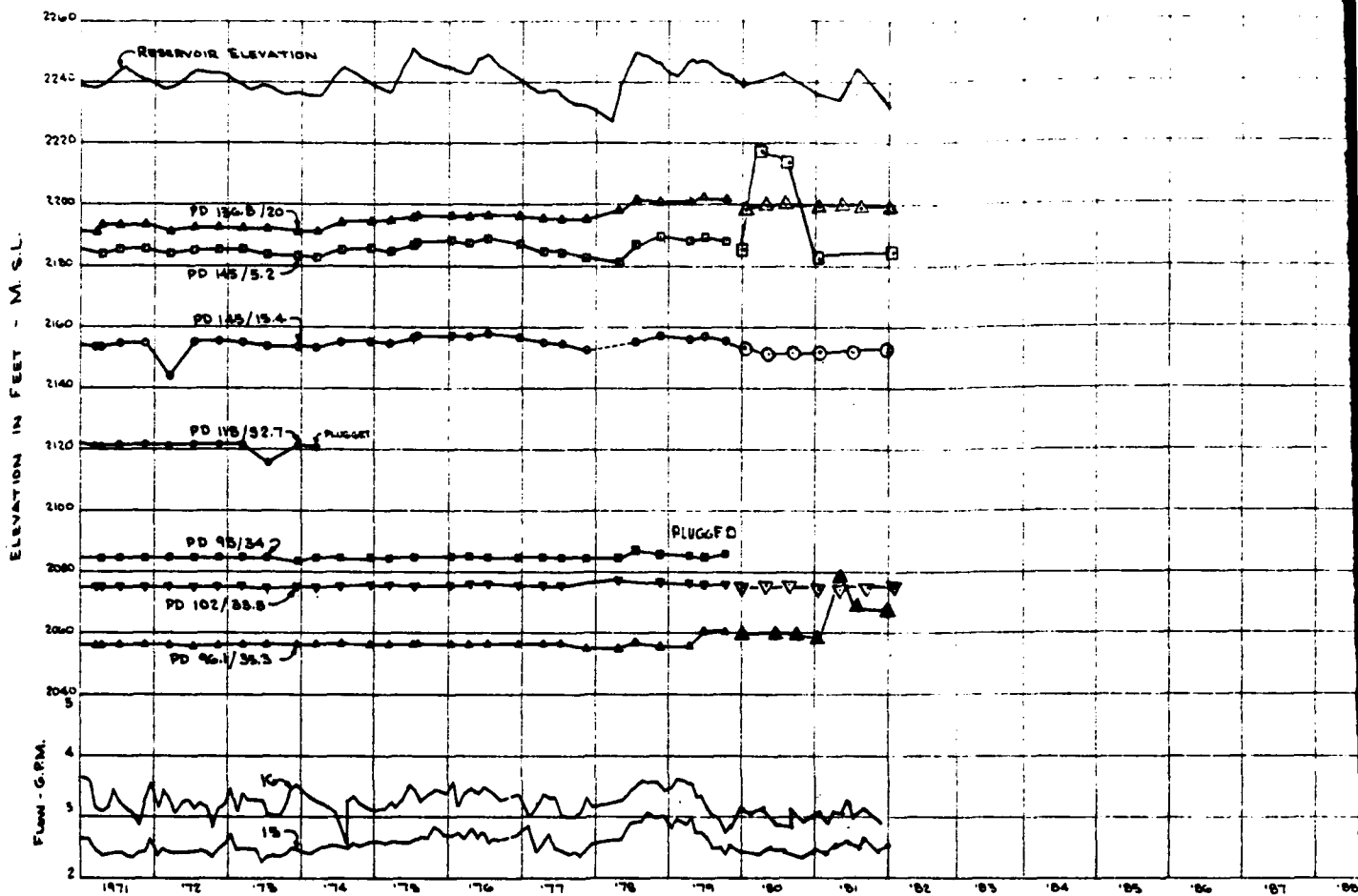
THIS PLAN ASSUMES CONTRACT NO. NEGOTIATION NO.

DATE	DESCRIPTION	BY	APPROVED
REVISIONS			
U. S. ARMY ENGINEER DISTRICT, OMAHA			
CORPS OF ENGINEERS			
OMAHA, NEBRASKA			
MISSOURI RIVER			
FORT PECK LAKE, MONTANA			
LEFT ABUTMENT RELIEF WELLS AND			
PIEZOMETERS			
COULER "C"			
DESIGNED BY	DATE		
DRAWN BY	DATE		
CHECKED BY	DATE		
APPROVED BY	DATE		
SCALE AS SHOWN		DATE	

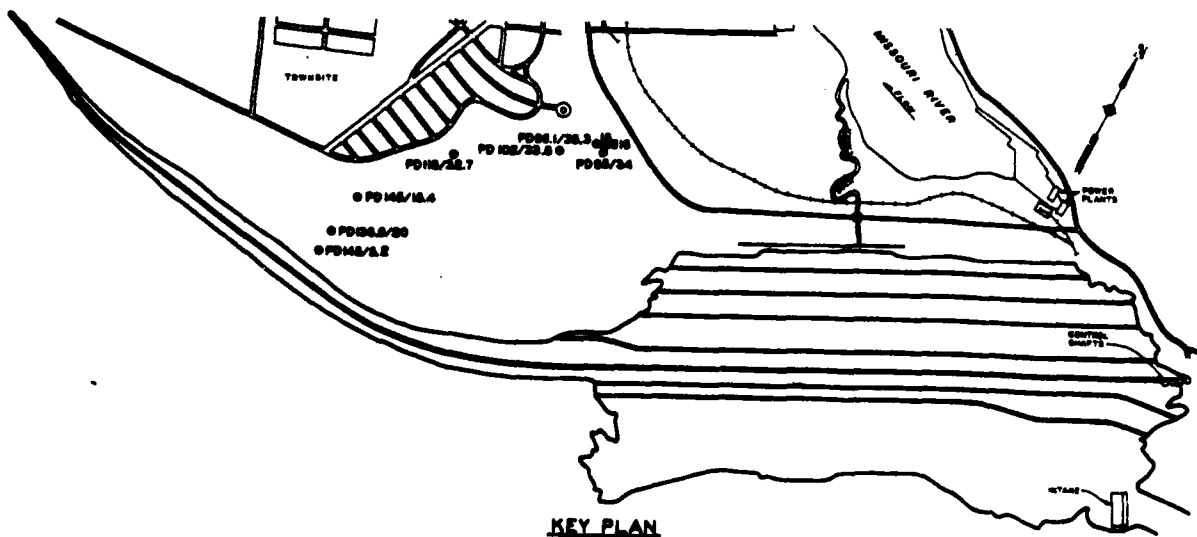
CONSTRUCTION FOUNDATION REPORT

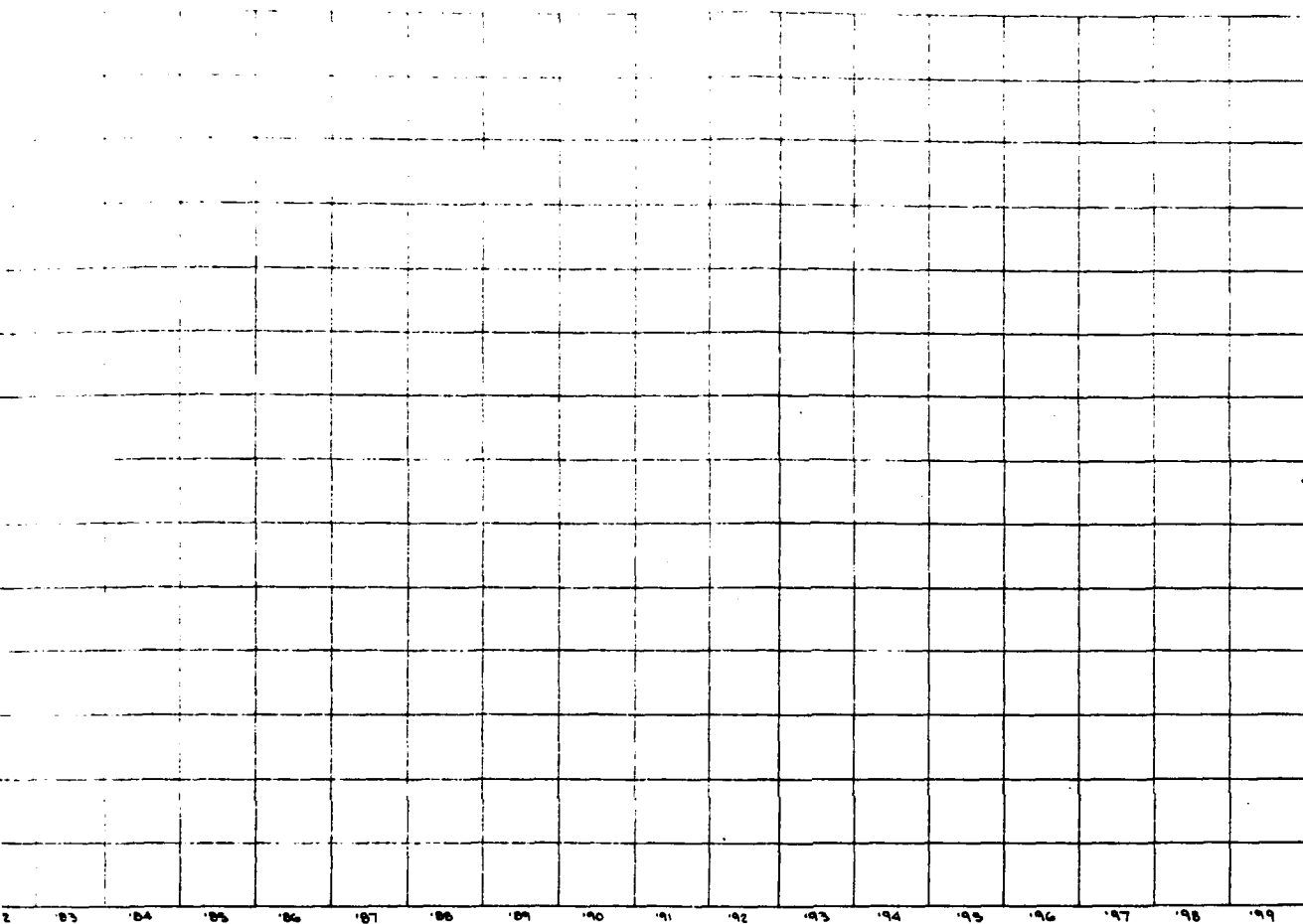
PLATE 77

2

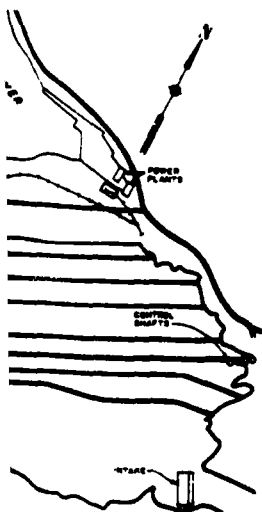


PIECES
PD 156.5/20
PD 145/5.2
PD 145/15.4
PD 118/32.7
PD 95/34.2
PD 102/33.8
PD 96.1/34.3
PLUGGED





** PIEZOMETER TESTED FOR EFFECTIVENESS DURING AUG 1977;
 PD 741/25-2 AND PD 146/52 HAD TIME LAG OF 7 TO 14 DAYS,
 PD 118/377 HAD BEEN PLUGGED. ALL OTHER INSTRUMENTS
 RESPONDED IMMEDIATELY.



THIS DRAWING HAS BEEN REDUCED TO
 THREE-EIGHTHS THE ORIGINAL SCALE.



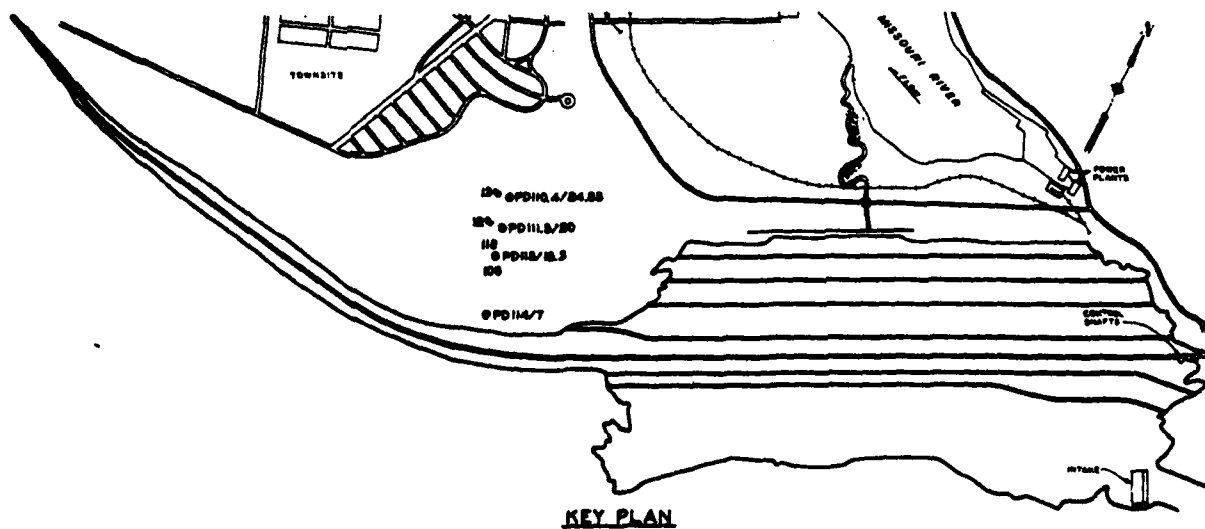
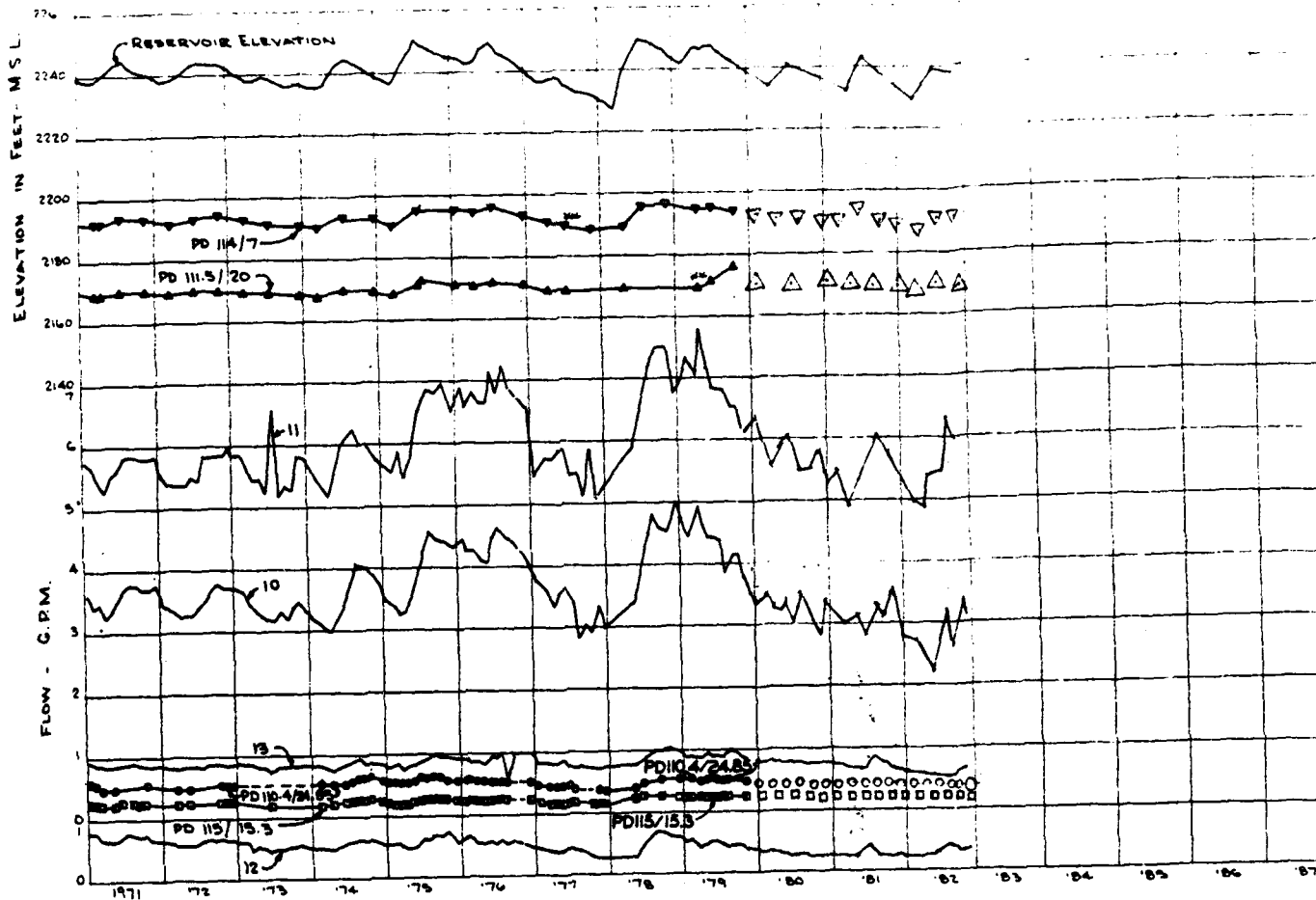
THIS PLAN ACCOMPANIES CONTRACT NO.
 MODIFICATION NO.

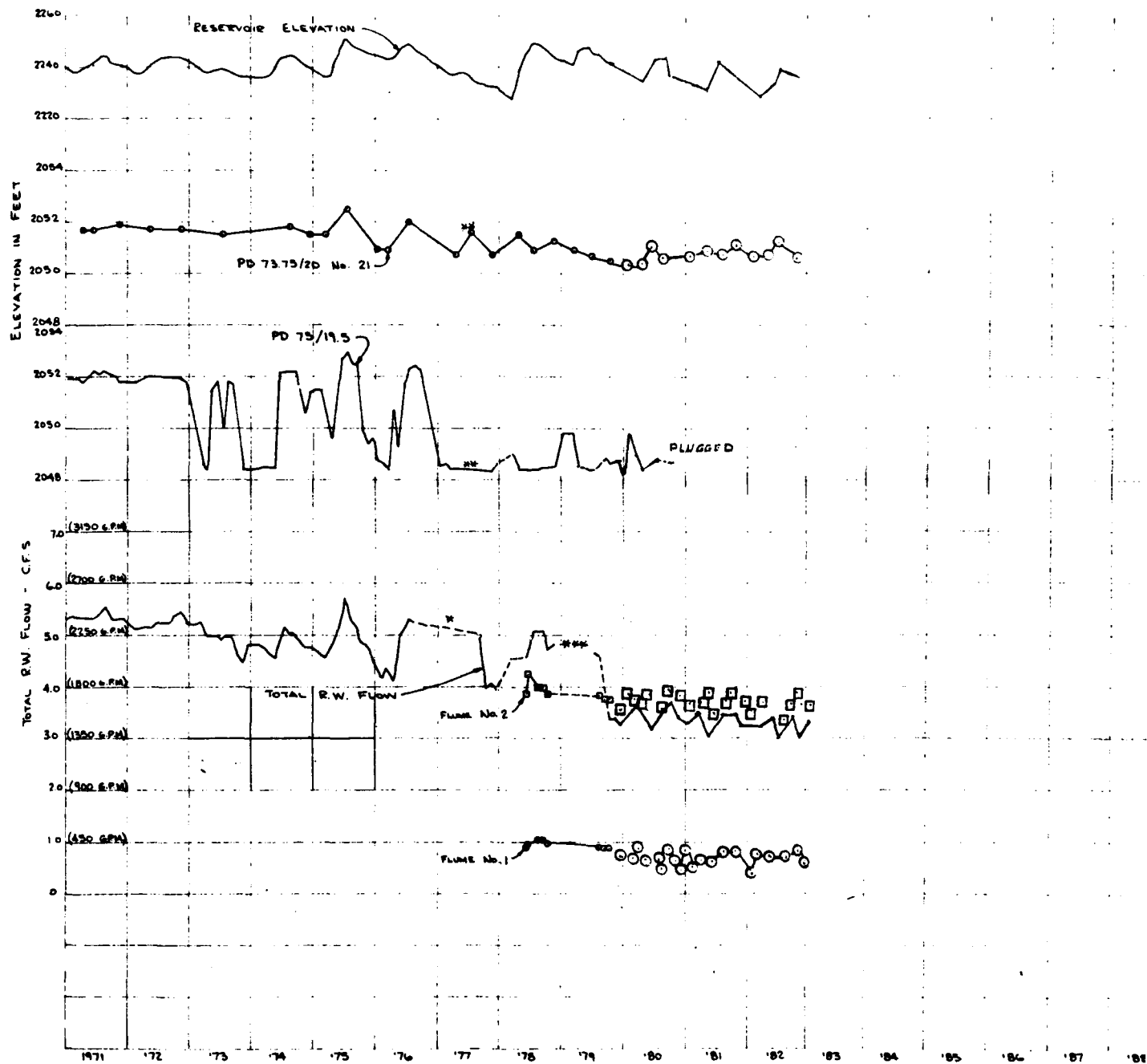
DATE		DESCRIPTION		DATE	GROUP
DIVISION					
U. S. ARMY ENGINEER DISTRICT, OMAHA					
CORPS OF ENGINEERS					
OMAHA, NEBRASKA					
MISSOURI RIVER					
FORT PECK LAKE, MONTANA					
LEFT ABUTMENT RELIEF WELLS AND					
PIEZOMETERS					
COULLEE "D"					
DESIGNED BY	DATE	CHECKED BY	DATE		
DRAWN BY	DATE	APPROVED BY	DATE		
SCALE AS SHOWN		SHEET NO.			

CONSTRUCTION FOUNDATION REPORT

PLATE 78

2



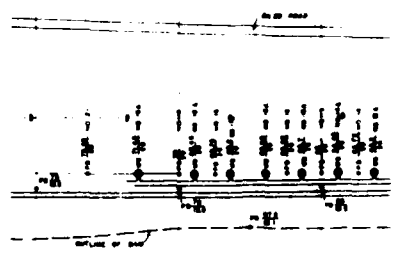


NOTE: TOTAL RELIEF WELL FLOW IS SUMMATION OF INDIVIDUAL R.W. FLOWS. THE SUM OF FLUME NO. 1 AND FLUME NO. 2 SHOULD APPROXIMATE THE TOTAL R.W. FLOW.
 * WELLS 10A, 10B AND 10C UNDER REPAIR.
 ** FLOWMETER TOTAL FLOW FEELING DURING JULY 1977. ALL WELLS ARE IN.
 *** WELLS 11A AND 12A UNDER REPAIR.

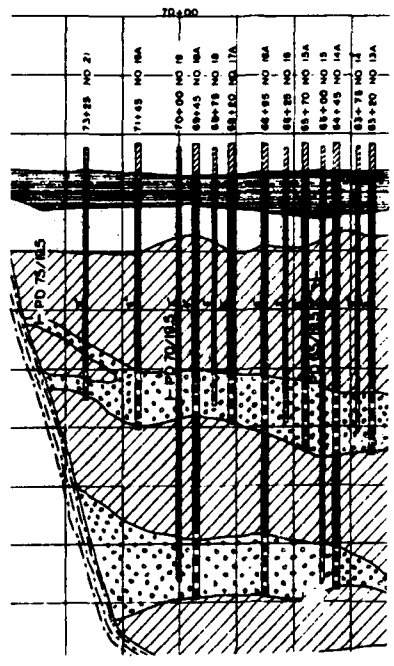
PC
VV

ocg

'82 '83 '84 '85 '86 '87 '88 '89 '90 '91 '92 '93 '94



PLAN
SCALE 1" = 100' FEET



PROFILE AT RANGE 20+00

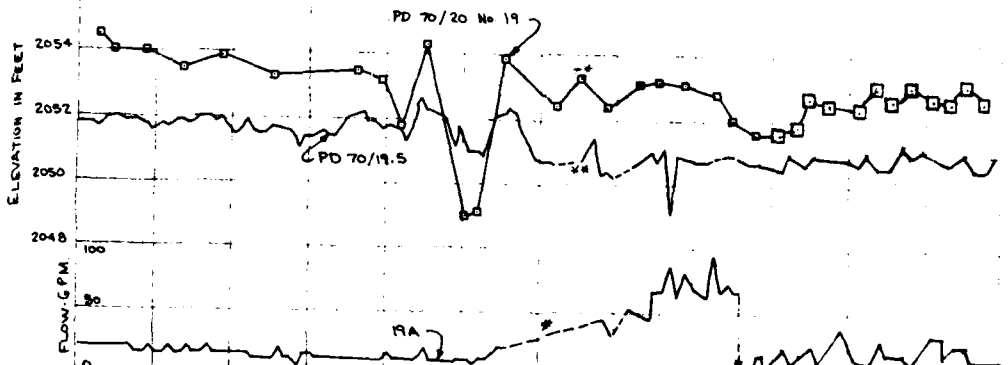
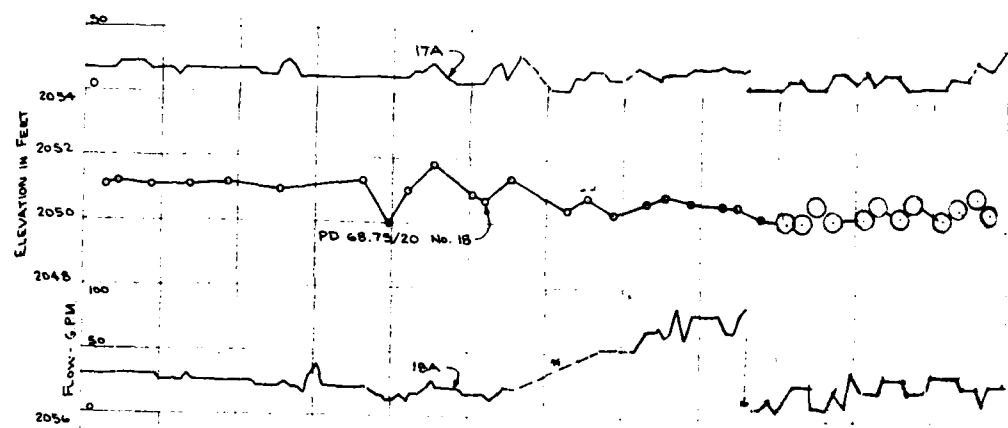
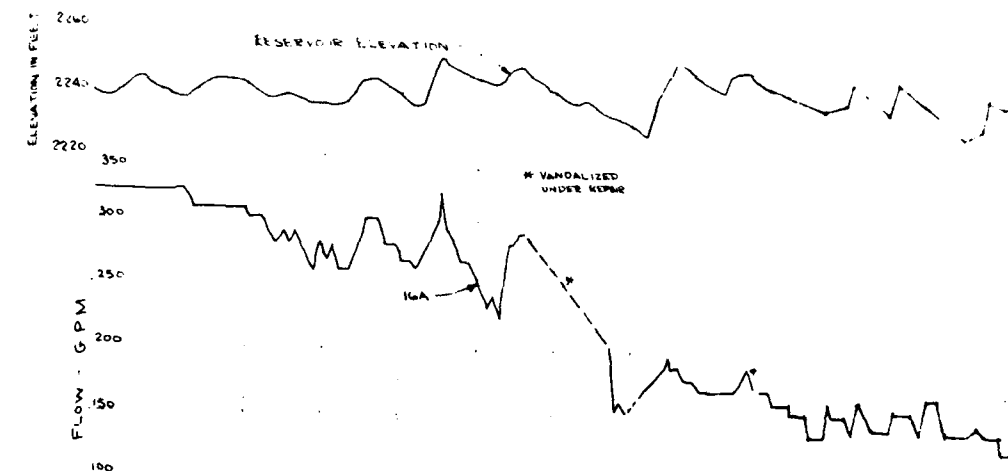
THIS DRAWING HAS BEEN REDUCED TO
THREE-EIGHTHS THE ORIGINAL SCALE.



THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.

REVISIONS	
DATE	DESCRIPTION

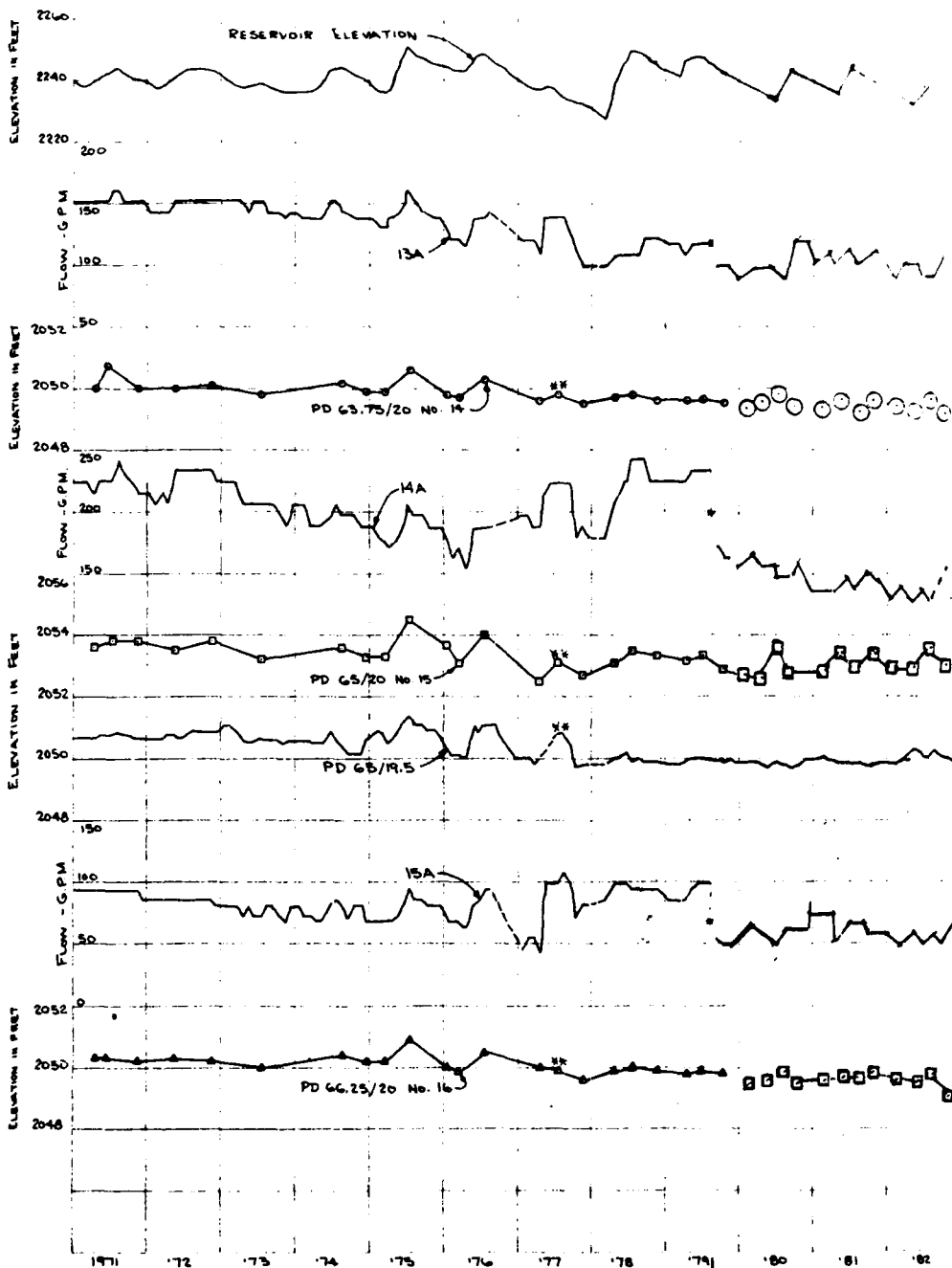
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA	
MISSOURI RIVER FORT PECK DAM DOWNSTREAM TIE AREA RELIEF WELLS AND RELIEF WELL PIEZ	
DESIGNED BY:	
DRAWN BY:	
CHECKED BY:	
APPROVED BY:	
DATE:	
BY:	
DATE:	
BY:	
DATE:	



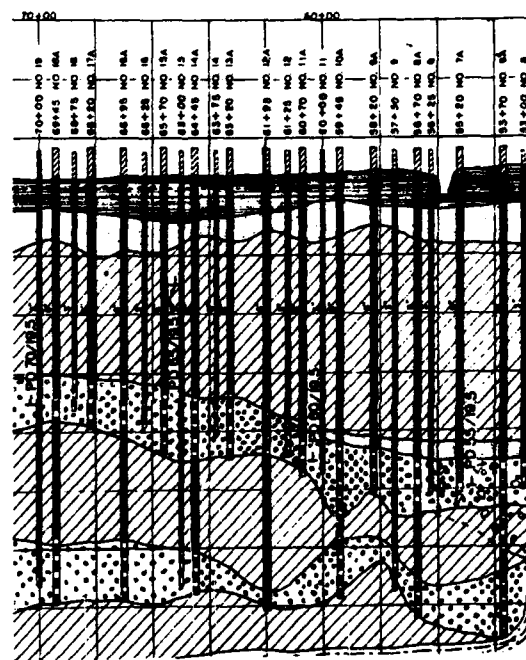
NOTE: # UNDER KEPR

F 220/11.5 TESTED FOR RESONANCE
DURING JULY 1977. ALL PILES ADEQUATE

Weir Recalibrated 8-9-79



** NOTE: ALL DATA IN THIS FILE ARE FROM THE WEIR
 RECALIBRATED 8-9-79. ALL DATA ARE IN FEET.



THIS DRAWING HAS BEEN REDUCED TO
THREE-EIGHTHS THE ORIGINAL SCALE

DISSEMINATION
DD FORM 10-78

**U. S. ARMY ENGINEER DISTRICT, OMAHA
GROUP OF ENGINEERS
OMAHA, NEBRASKA**

DESIGNED BY:

 DRAWN BY:

 CHECKED BY:

 APPROVED BY:

 DATE: TIME:
 INITIALS:

**MISSOURI RIVER
FORT PECK DAM

DOWNSTREAM TDS AREA

RELIEF WELLS AND RELIEF WELL PIETZ**

DATE:
DRAWING NUMBER:
SCALE:

APPROVAL:
CLASS AND SYMBOL:
OTHER USE:

DRAWING REVISION

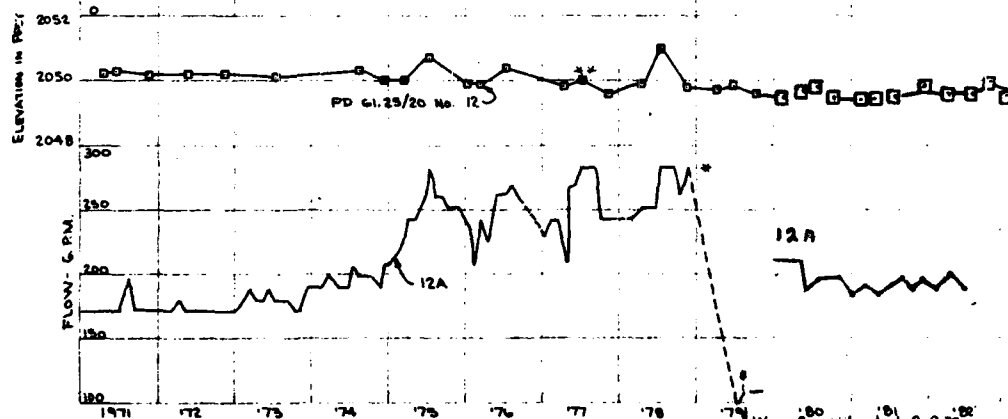
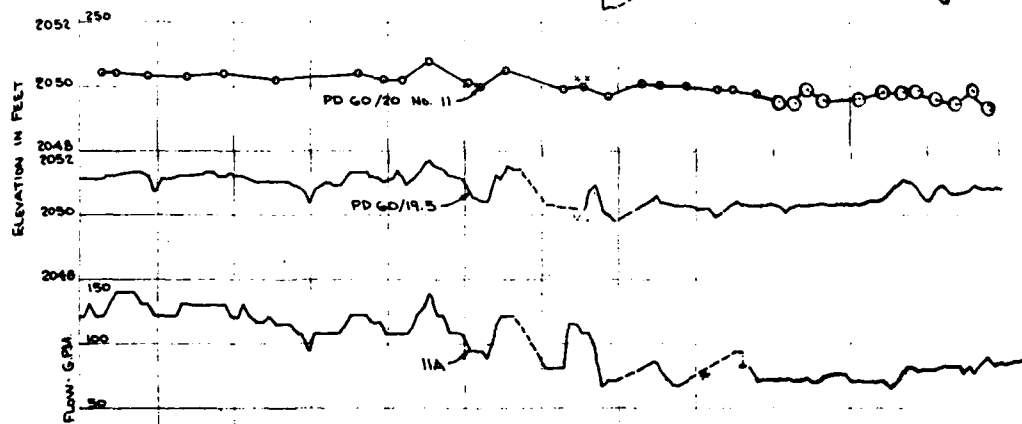
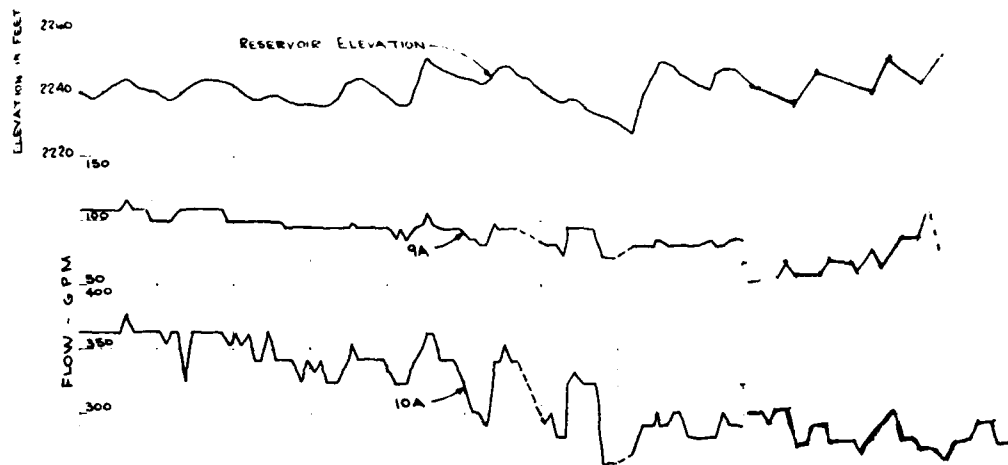
U.S.G. OFFICE SYMBOL UNIT

THIS PLAN ACCOMPANIES CERTAINLY NO
REGISTRATION NO

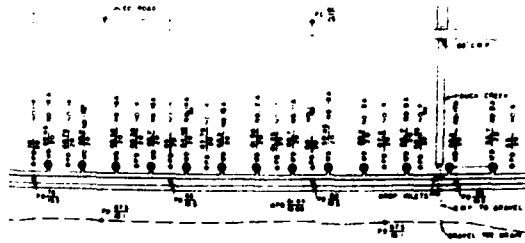
CONSTRUCTION FOUNDATION REPORT

PLATE 81

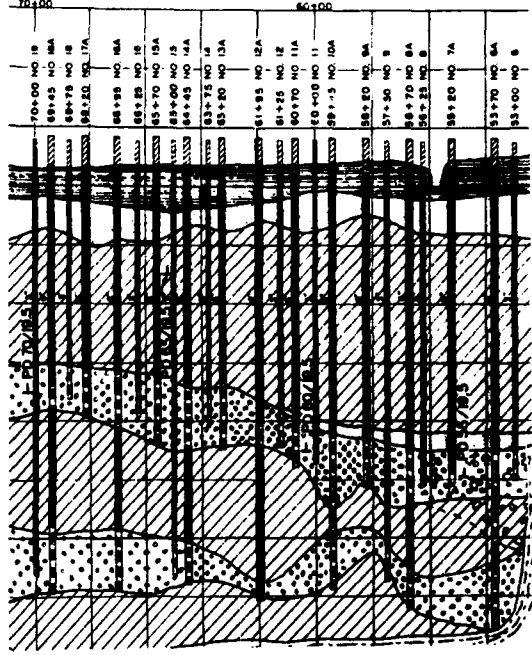
2



NOTE: * Weir Recalibrated 8-9-79
 ** UNDER REPAIR
 *** PIEZOMETERS TYPICAL FOR THIS FACILITY
 DURING JULY 1972 ALL WERE ADEQUATE



PLAN
SCALE 0 100 200 300 400 500 FEET

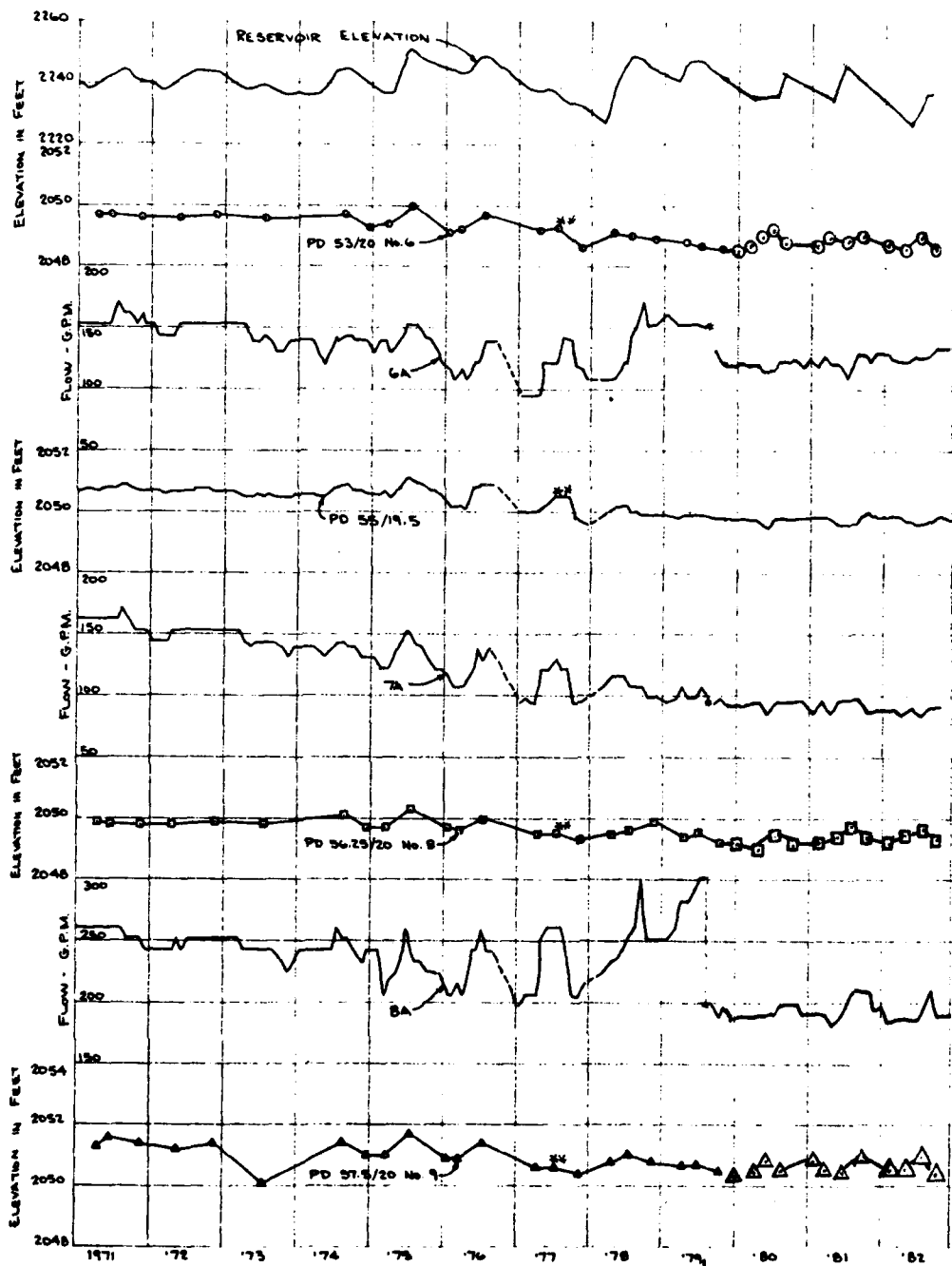


PROFILE AT RANGE 20+00

THIS DRAWING HAS BEEN REDUCED TO
THREE-EIGHTS THE ORIGINAL SCALE.

DATE		DESCRIPTION	SCALE	APPROVED
REVISIONS				
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA				
DESIGNED BY		MISSOURI RIVER FORT PECK DAM		
CHECKED BY		DOWNSTREAM TOE AREA		
CONSTRUCTED BY		RELIEF WELLS AND RELIEF WELL PIER		
DATE	BY	DATE	BY	DATE
THIS PLAN ACCOMPANIES CONTRACT NO.		CONSTRUCTION NO.		





** NOTE: PIEZOMETER TESTED FOR LEAK DURING JULY 1971 AS WEIR WAS CALIBRATED.

Weir Recalibrated 8-9-79



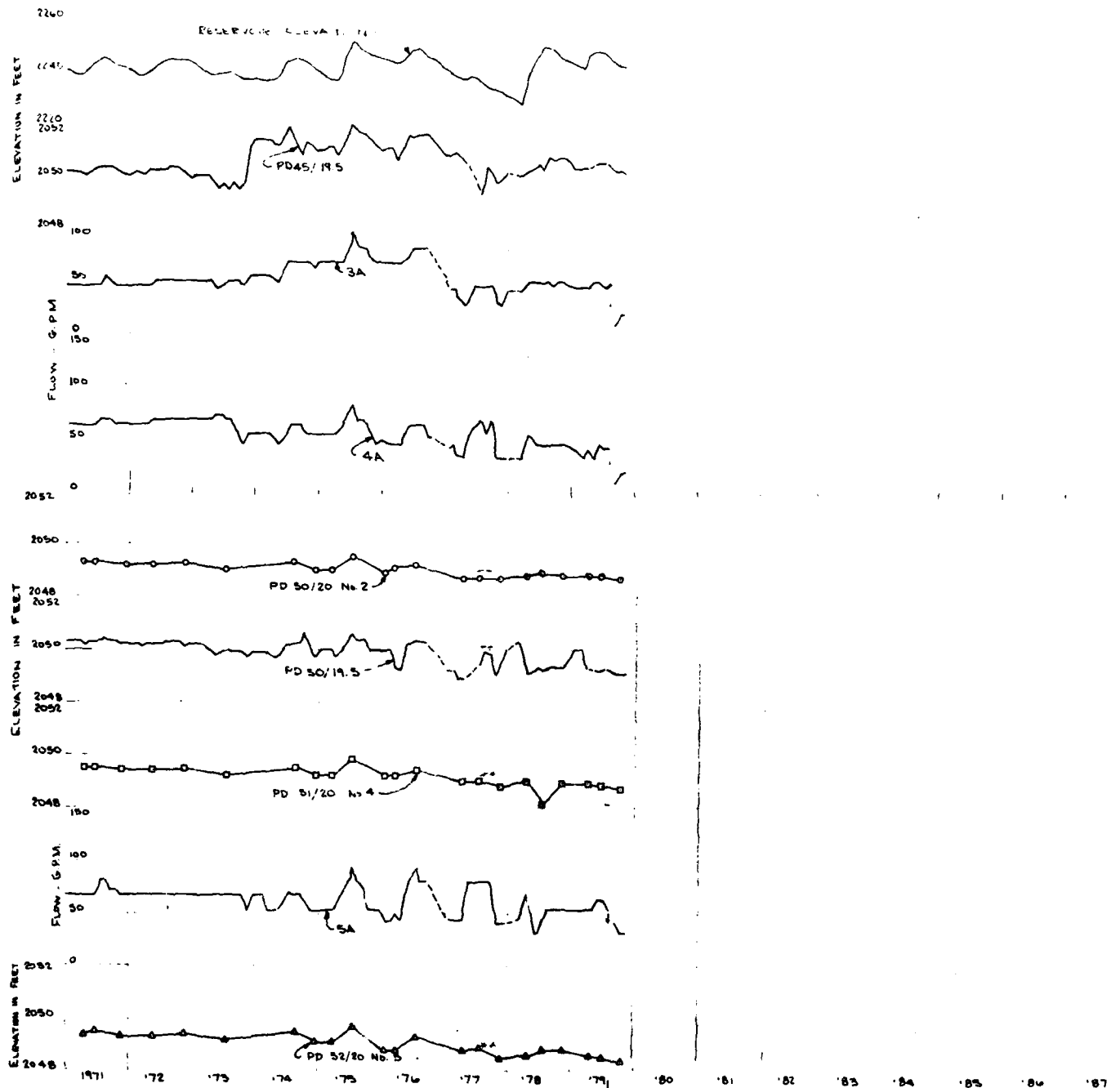
THIS DRAWING HAS BEEN REDUCED TO
THREE-EIGHTHS THE ORIGINAL SCALE.

DATE	ORIGINATOR	GRADE	APPROVE
DIVISION			
U. S. ARMY ENGINEER DISTRICT, OMAHA GROUP OF ENGINEERS OMAHA, NEBRASKA			
DESIGNED BY	MISSOURI RIVER FORT PECK DAM		
DRAWN BY			
CHECKED BY	DOWNSTREAM TIE AREA		
COMPUTED BY	RELIEF WELLS AND RELIEF WELL PIEZ.		
NO.			
REVISION			
DATE	BY	DATE	BY
APPROVE	GROUP ENGINEER	GROUP AS ENGINEER	GROUP AS

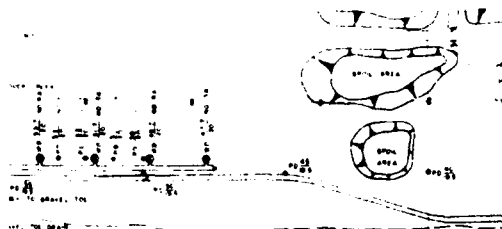
CONSTRUCTION FOUNDATION REPORT

PLATE 83

2

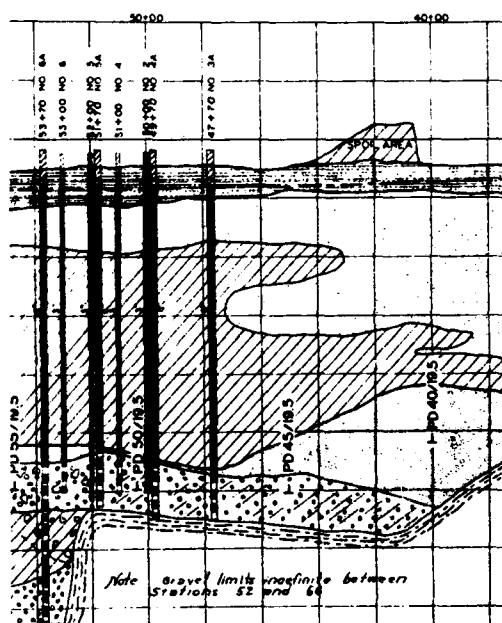


Weir Recalibrated 8-9-79



LEGEND

- Permanent Pressure Relief Wells
- Piezometer Pipes (Existing)



THIS DRAWING HAS BEEN REDUCED TO
THREE-EIGHTHS THE ORIGINAL SCALE.

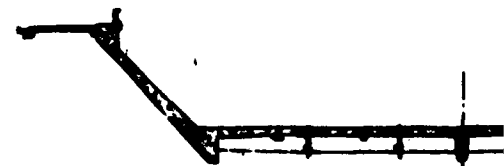
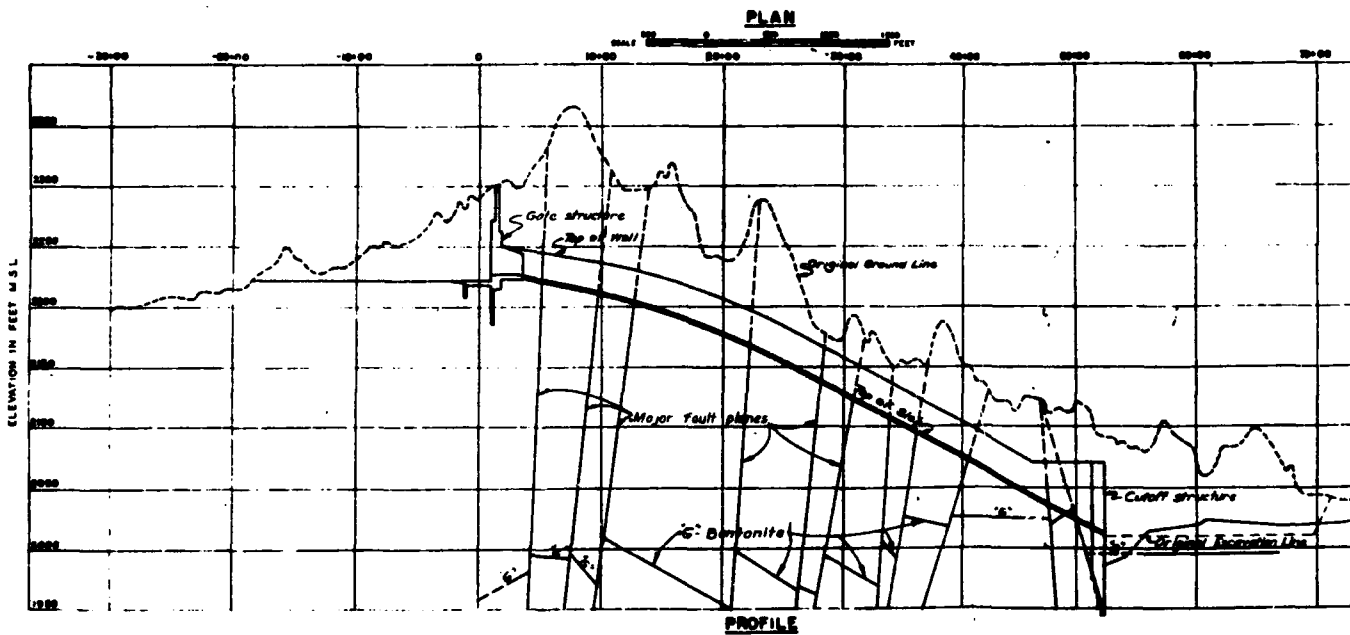
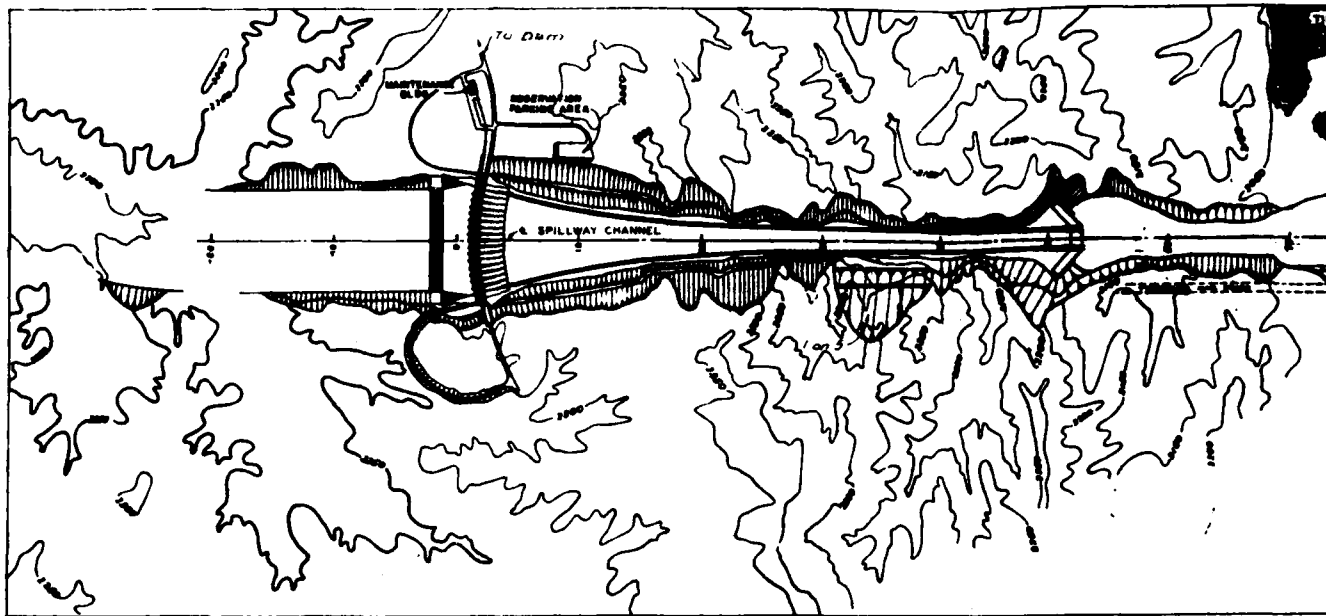
REVISIONS		DATE	DESCRIPTION	MADE BY	APPROVED BY
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA					
MISSOURI RIVER FORT PECK DAM DOWNSTREAM TOE AREA RELIEF WELLS AND RELIEF WELL PIER					
DESIGNED BY	DATE				
CHECKED BY	DATE				
APPROVED BY	DATE				
DRAWN BY					
CHECKED BY					
APPROVED BY					

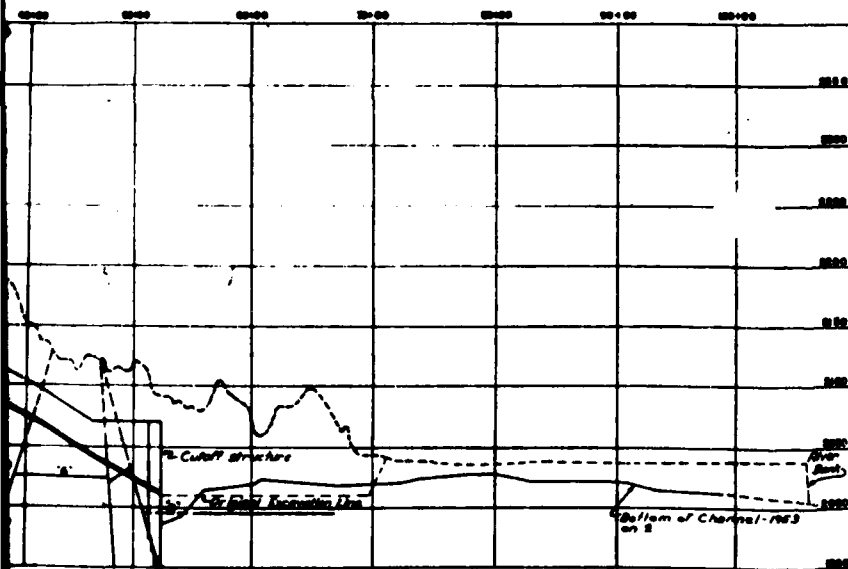
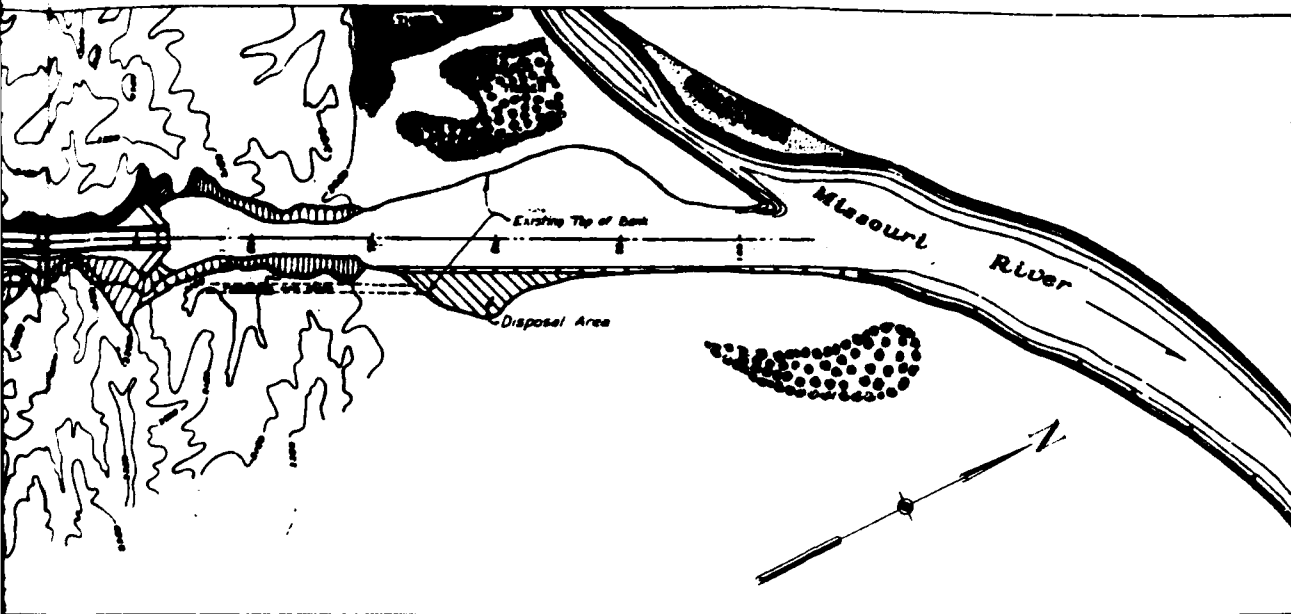


THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.

CONSTRUCTION FOUNDATION REPORT

2 PLATE 84





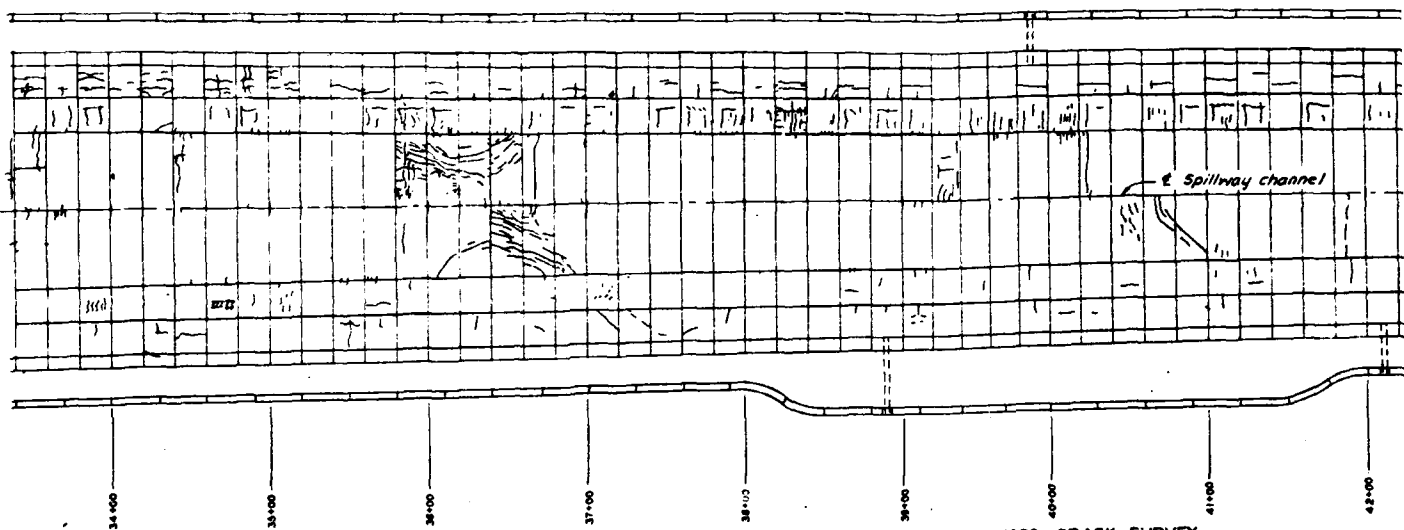
THIS DRAWING HAS BEEN REDUCED TO
THREE-EIGHTHS THE ORIGINAL SCALE.



TYPICAL SECTION THROUGH CHANNEL

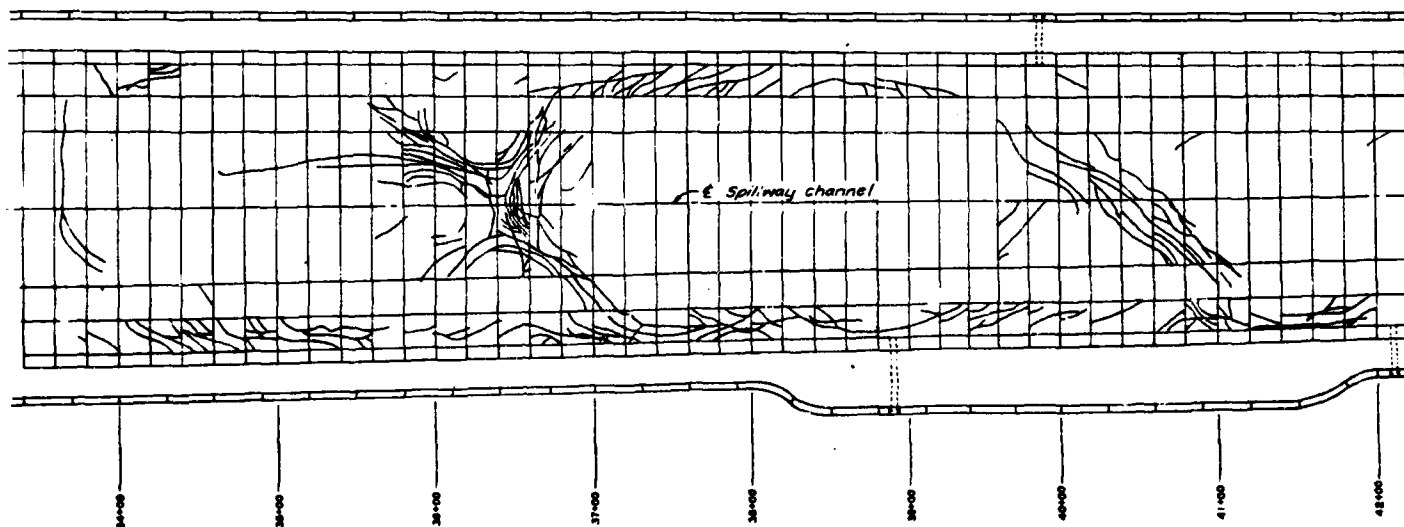
DATE		DESCRIPTION		MADE	APPROVED
DIVISION					
U. S. ARMY ENGINEER DISTRICT, OMAHA					
CORPS OF ENGINEERS					
OMAHA, NEBRASKA					
DESIGNED BY: C. V. J.		MISSOURI RIVER			
CHECKED BY: S. A. A.		FORT PECK DAM AND RESERVOIR			
DESIGNED BY: S. W. A.		SPILLWAY REHABILITATION			
CHECKED BY:		PLAN, PROFILE, TYPICAL SECTIONS			
DRAWN AND PUBLISHED BY:		AND SPOIL AREAS			
APPROVED:		DATE:		SEPT. 1900	
BY 1ST LIEUT. JAMES		BY 1ST LIEUT. JAMES		DATE: SEPT. 1900	
BY 1ST LIEUT. JAMES		BY 1ST LIEUT. JAMES		DATE: SEPT. 1900	

CORPS OF ENGINEERS



1939 CRACK SURVEY

SCALE 1 INCH = 40 FEET
0 40 80



1963 CRACK SURVEY

THIS DRAWING HAS BEEN REDUCED TO
THIRTY-FOURTH THE ORIGINAL SCALE.

AD A134 914

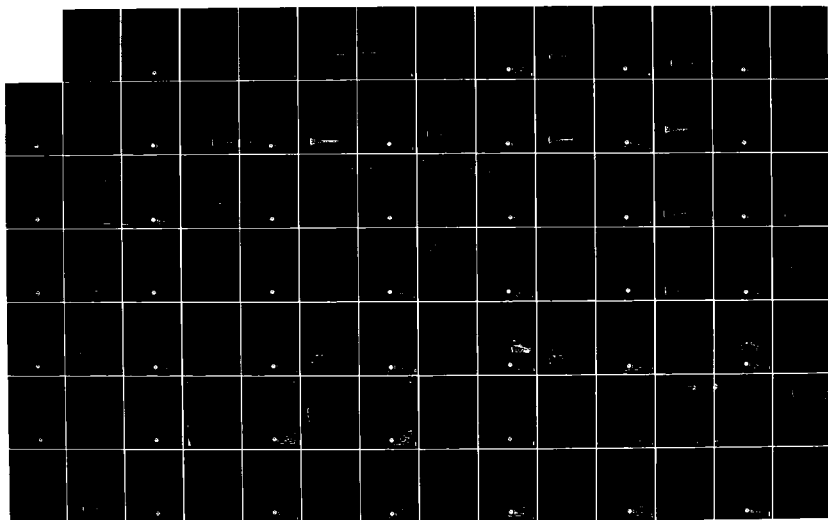
CONSTRUCTION FOUNDATION REPORT MISSOURI RIVER FORT PECK
MONTANA VOLUME 2 DRAWINGS(U) ARMY ENGINEER DISTRICT
OMAHA NE JAN 83.

3/4

UNCLASSIFIED

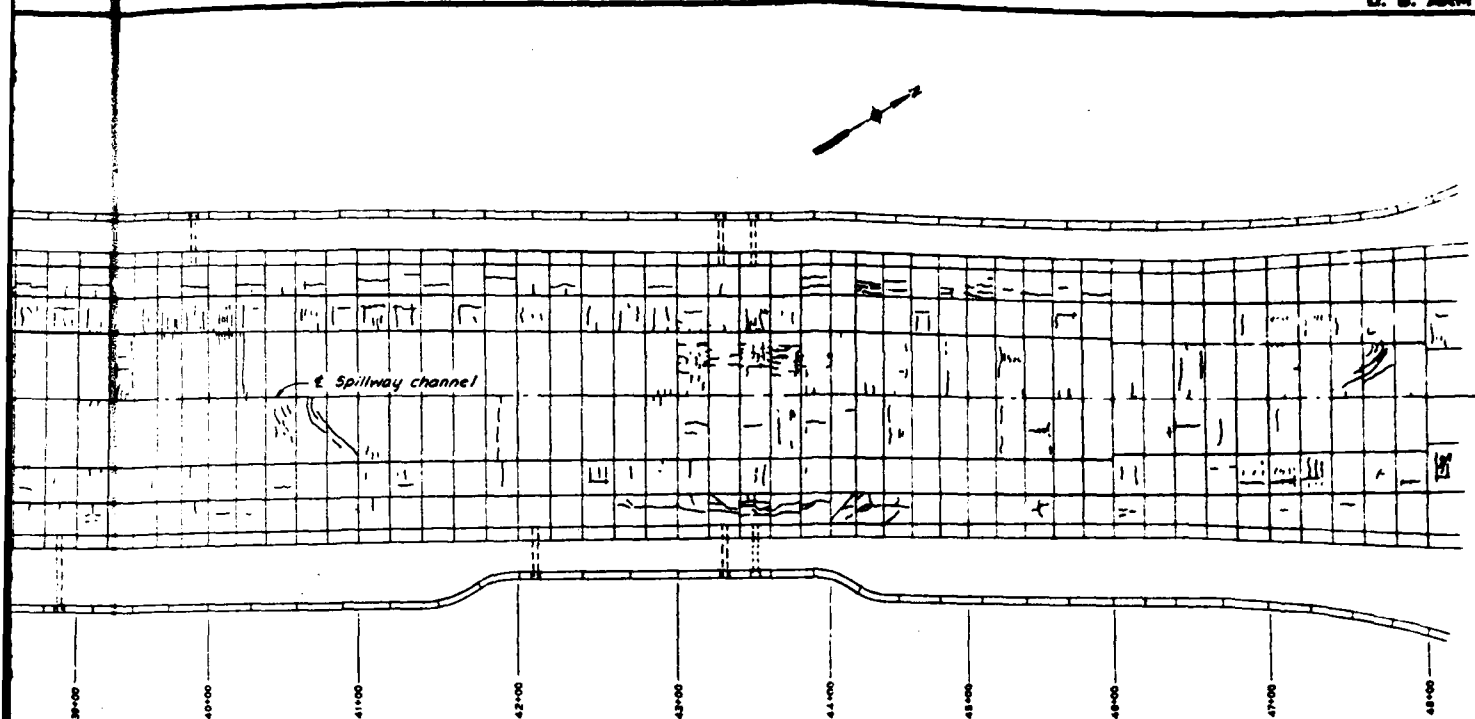
F/G 13/13

NI



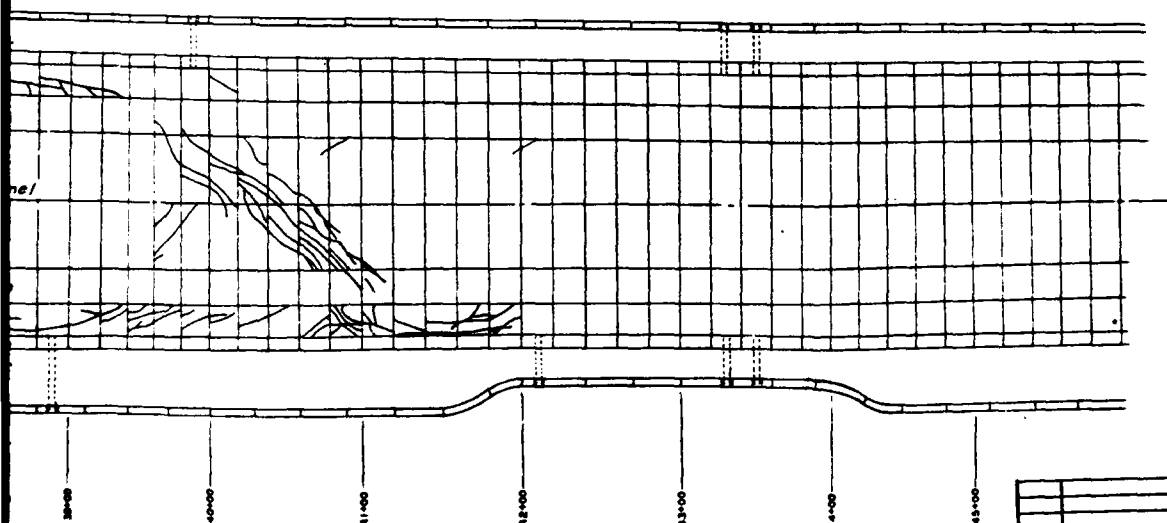


MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS - 1963 - A



1939 CRACK SURVEY

SCALE 1 INCH = 40 FEET



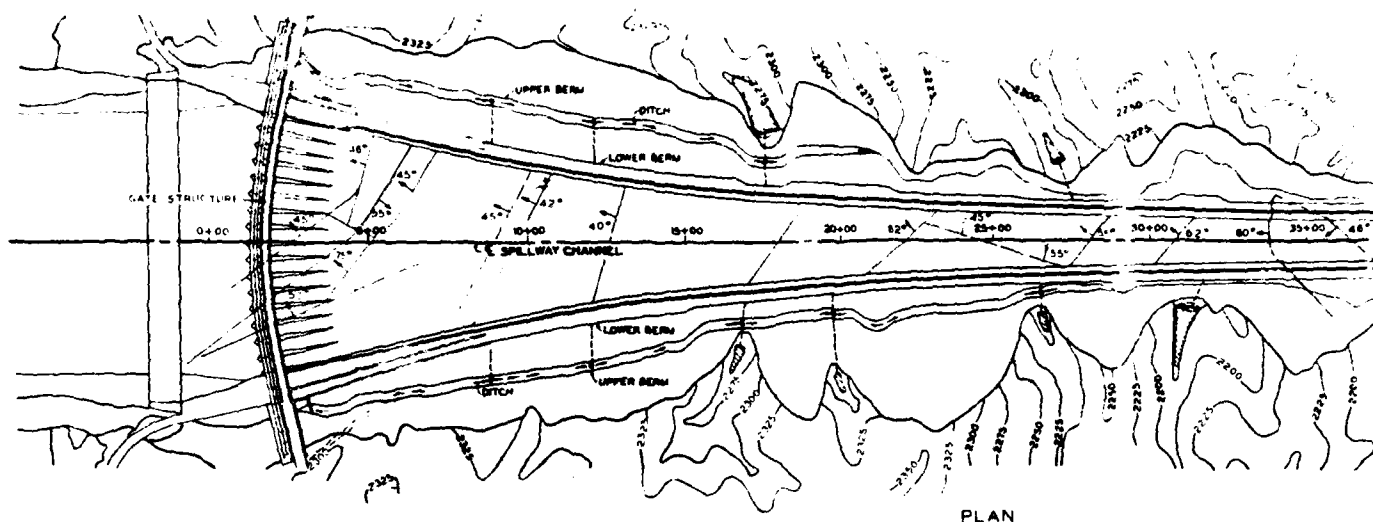
1963 CRACK SURVEY



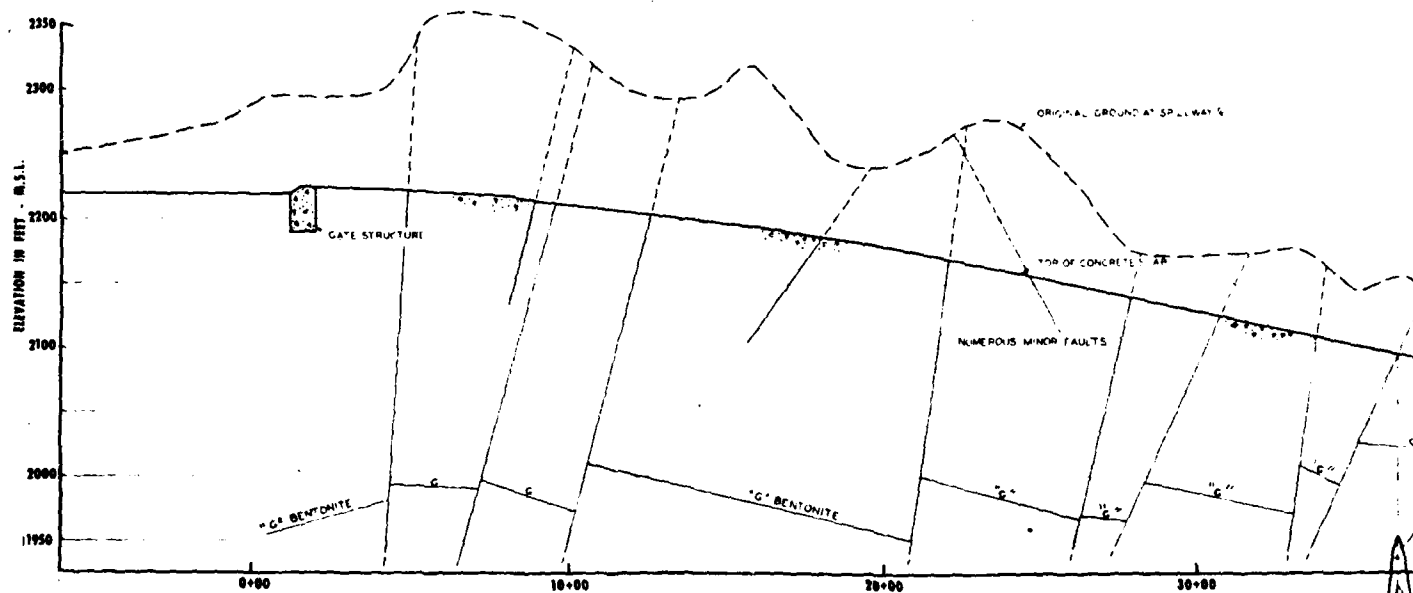
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA	
MISSOURI RIVER FORT PECK DAM AND RESERVOIR SPILLWAY REHABILITATION	
CRACK SURVEYS 1939 VS 1963	
DATE: SEPT. 1968	BY: <i>Charles E. Hupp</i>
CHECKED BY: <i>Shirley J. de Clair</i>	DATE: 10-1-68

THIS PLAN ACCOMPANIES CONTRACT NO. DA-28-000-100
MODIFICATION NO.

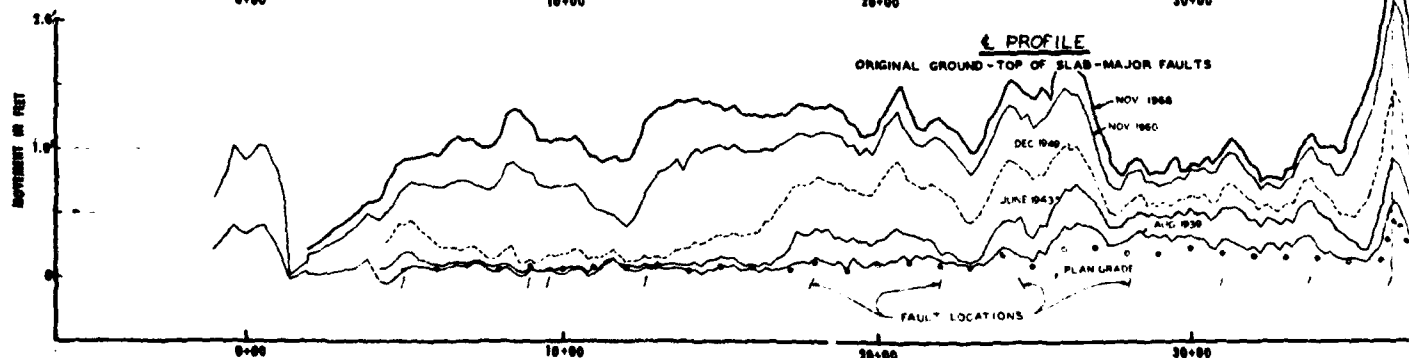
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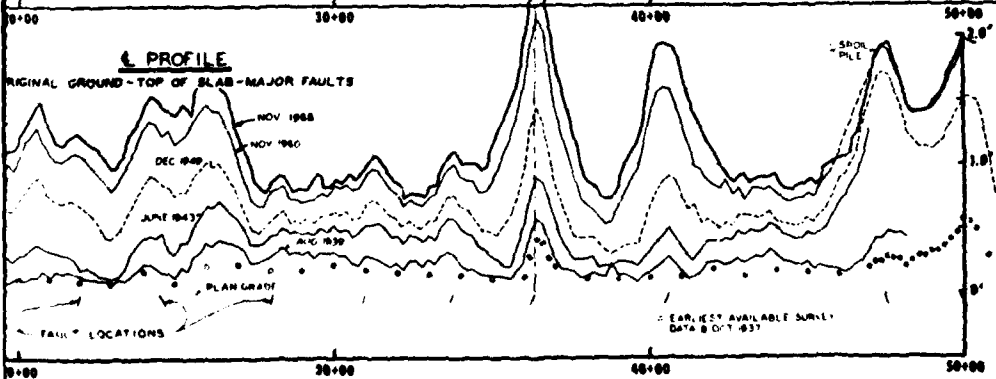
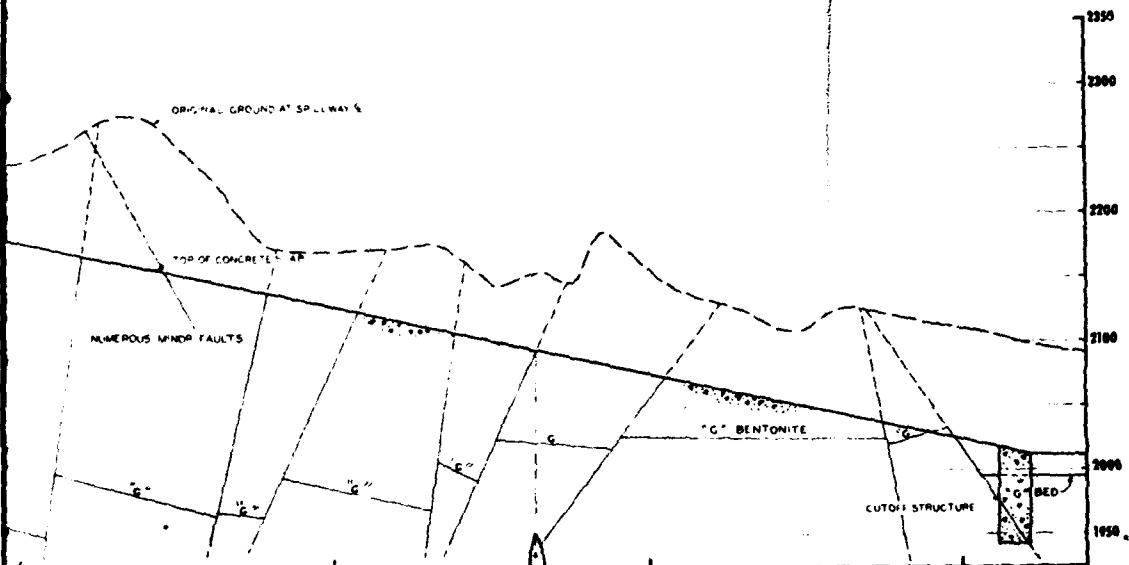
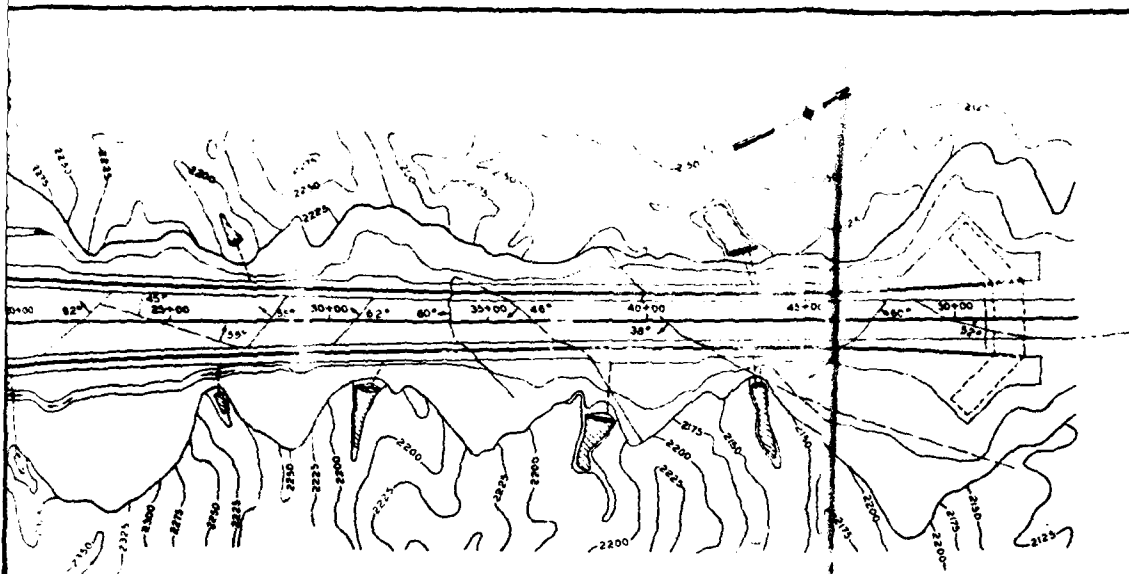
PLAN



PROFILE

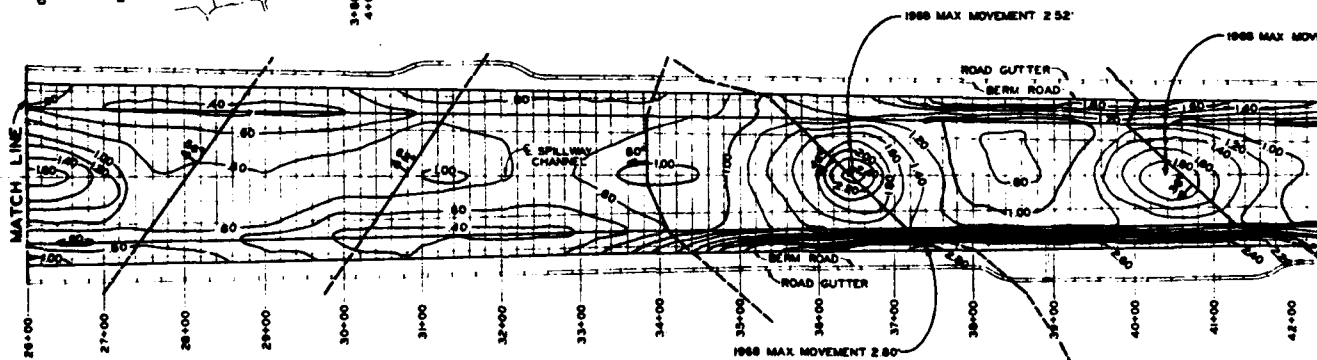
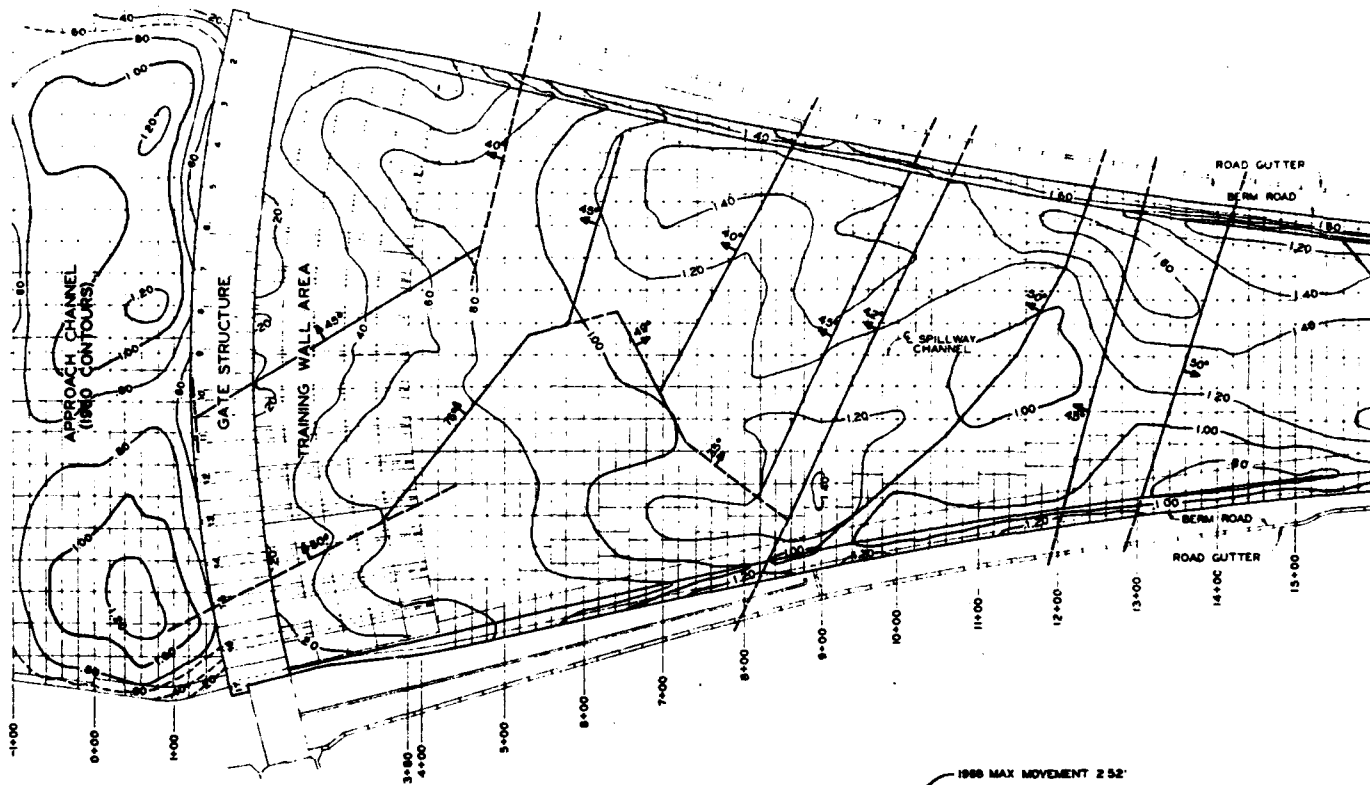


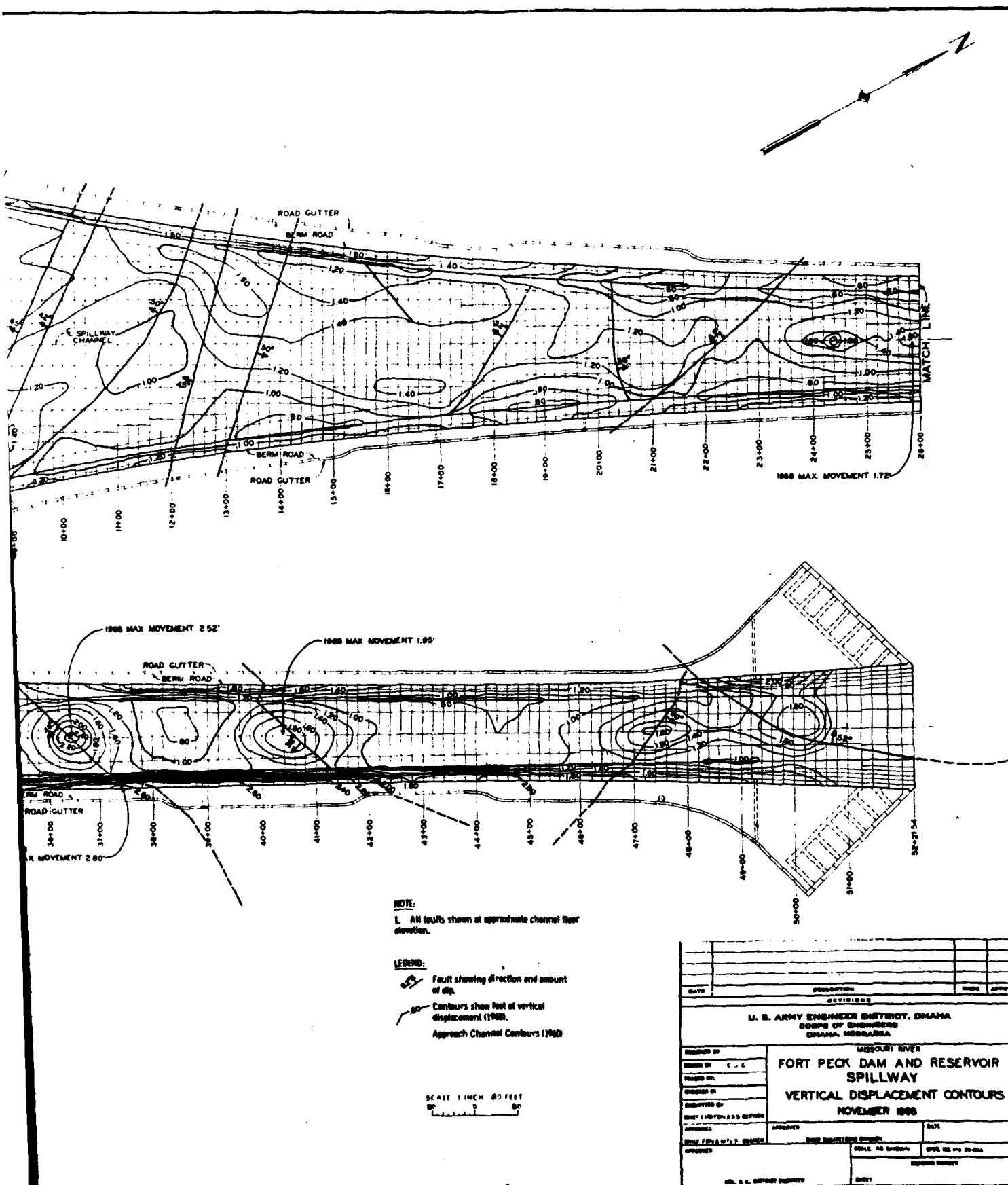
MOVEMENT PROFILE
SPILLWAY CHANNEL



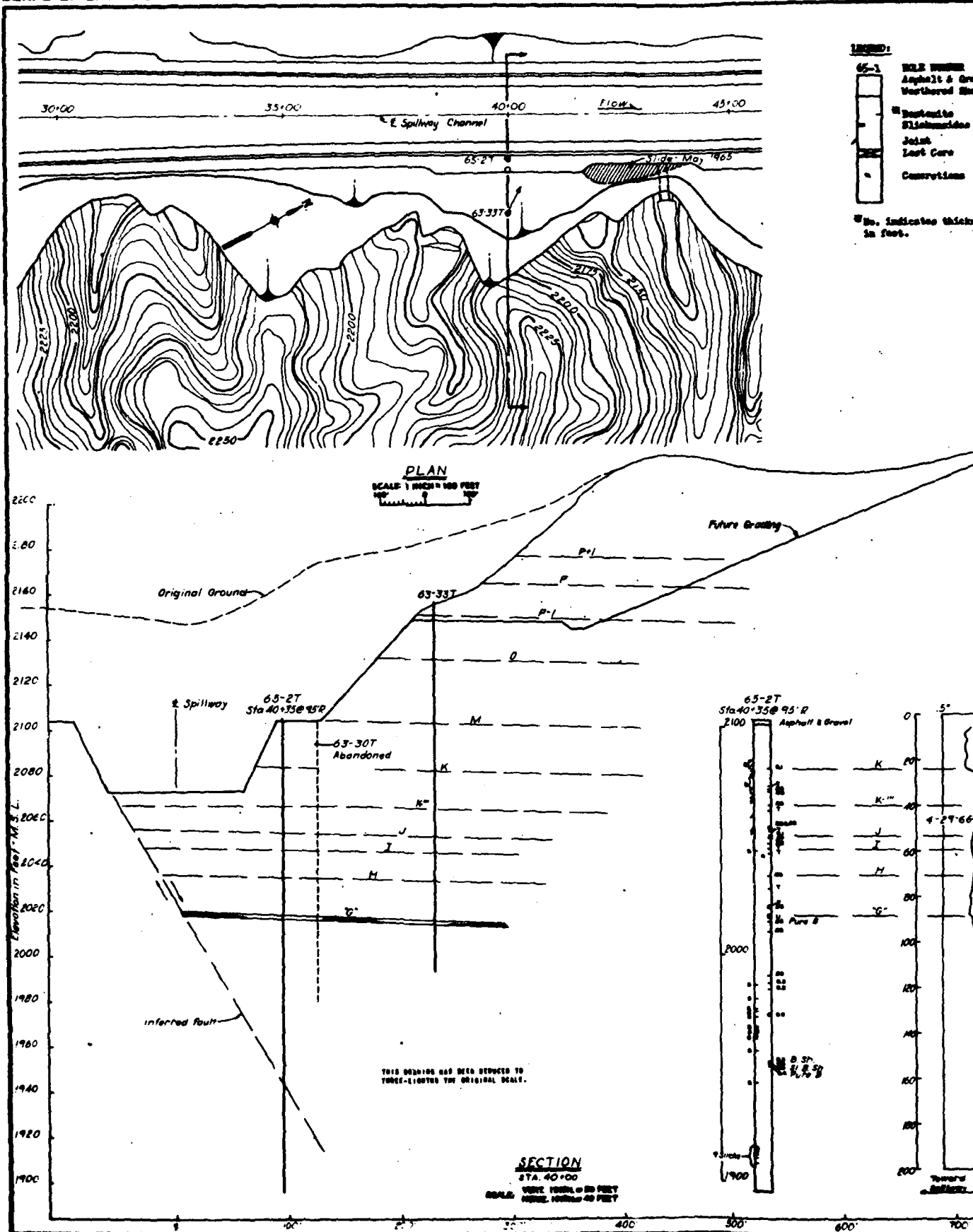
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA	
MISSOURI RIVER FORT PECK DAM AND RESERVOIR SPILLWAY CENTERLINE VERTICAL MOVEMENT	
DESIGNED BY: C. L. F.	DATE: 1-1-44
CHECKED BY: S. W. A.	DATE: 1-1-44
APPROVED BY: S. W. A.	DATE: 1-1-44
DESIGNED BY: S. W. A.	DATE: 1-1-44
CHECKED BY: S. W. A.	DATE: 1-1-44
APPROVED BY: S. W. A.	DATE: 1-1-44
DESIGNED BY: S. W. A.	DATE: 1-1-44
CHECKED BY: S. W. A.	DATE: 1-1-44
APPROVED BY: S. W. A.	DATE: 1-1-44

2





CORPS OF ENGINEERS

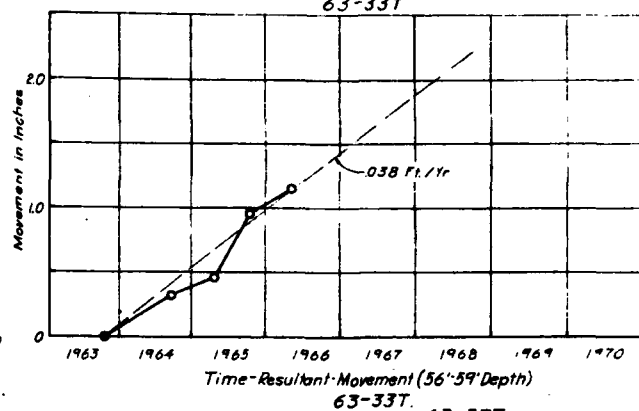
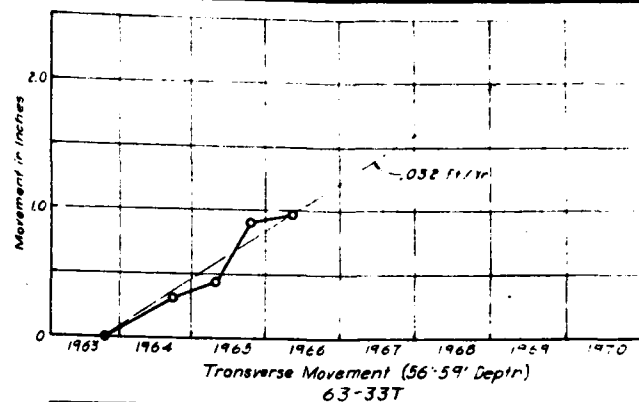
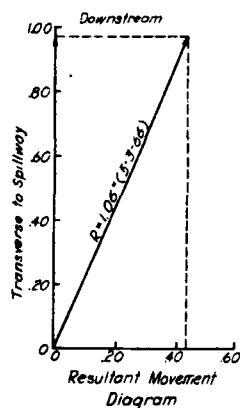




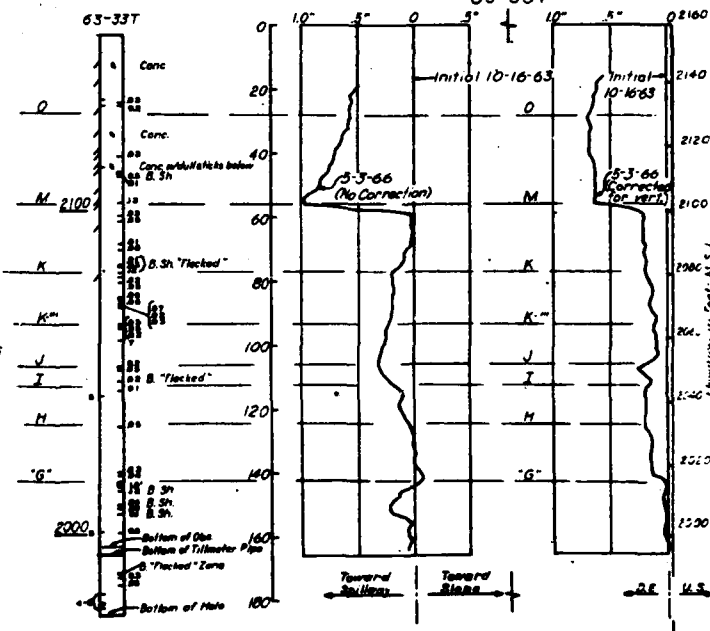
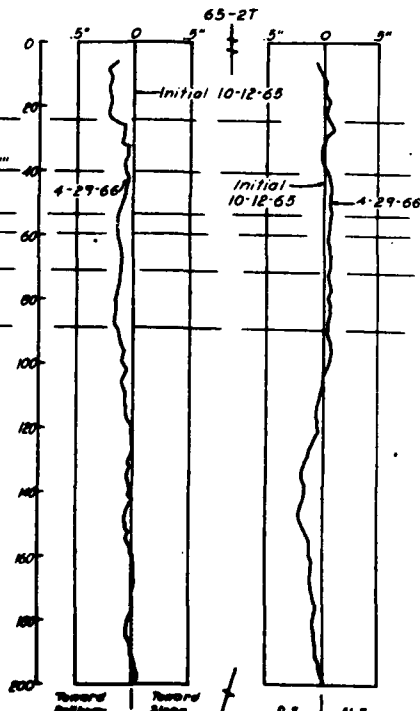
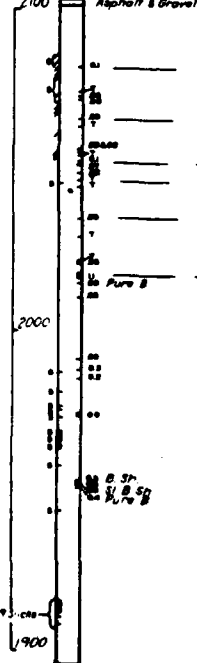
LEGEND:

- 65-1 R.C.L. FURROW
Asphalt & Gravel or
Weathered Shale
- Portlandite
Slickensides
Joint
Lost Core
Concretions

No. indicates thickness
in feet.

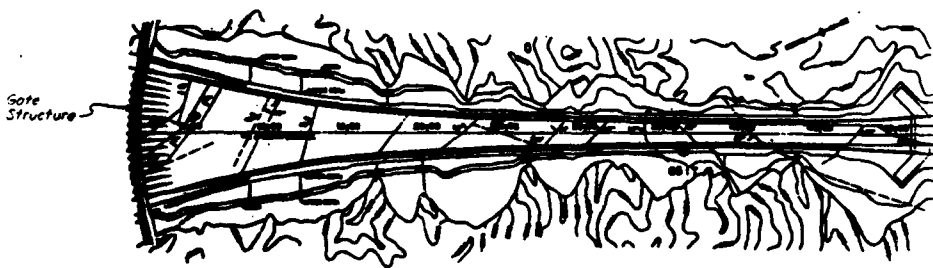
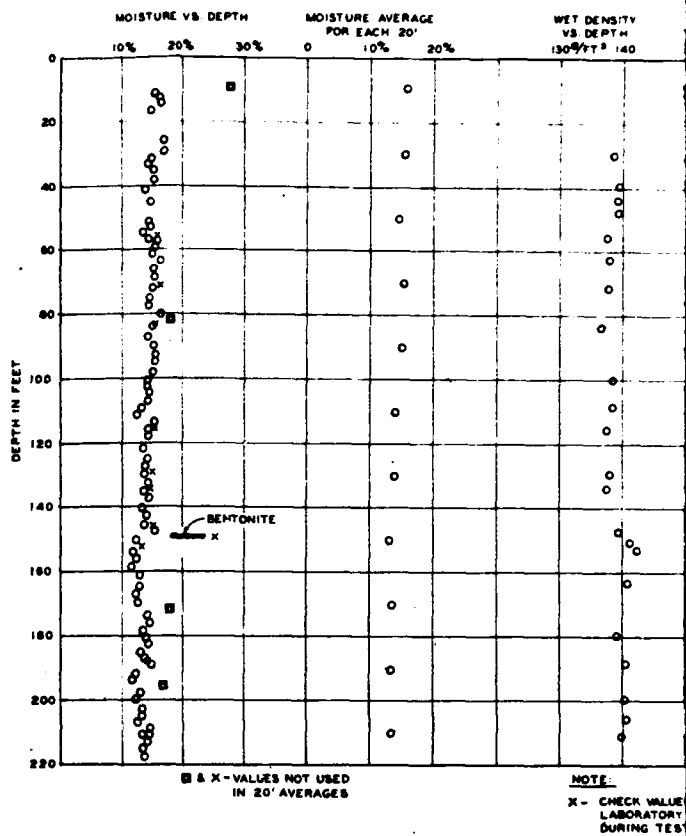
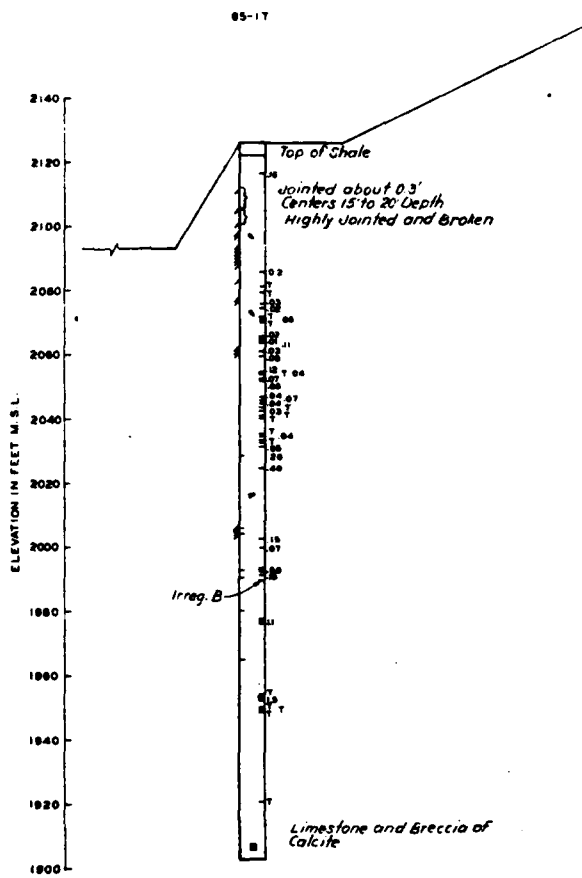


65-2T
Sta 40+35 @ 95' P
Asphalt & Gravel



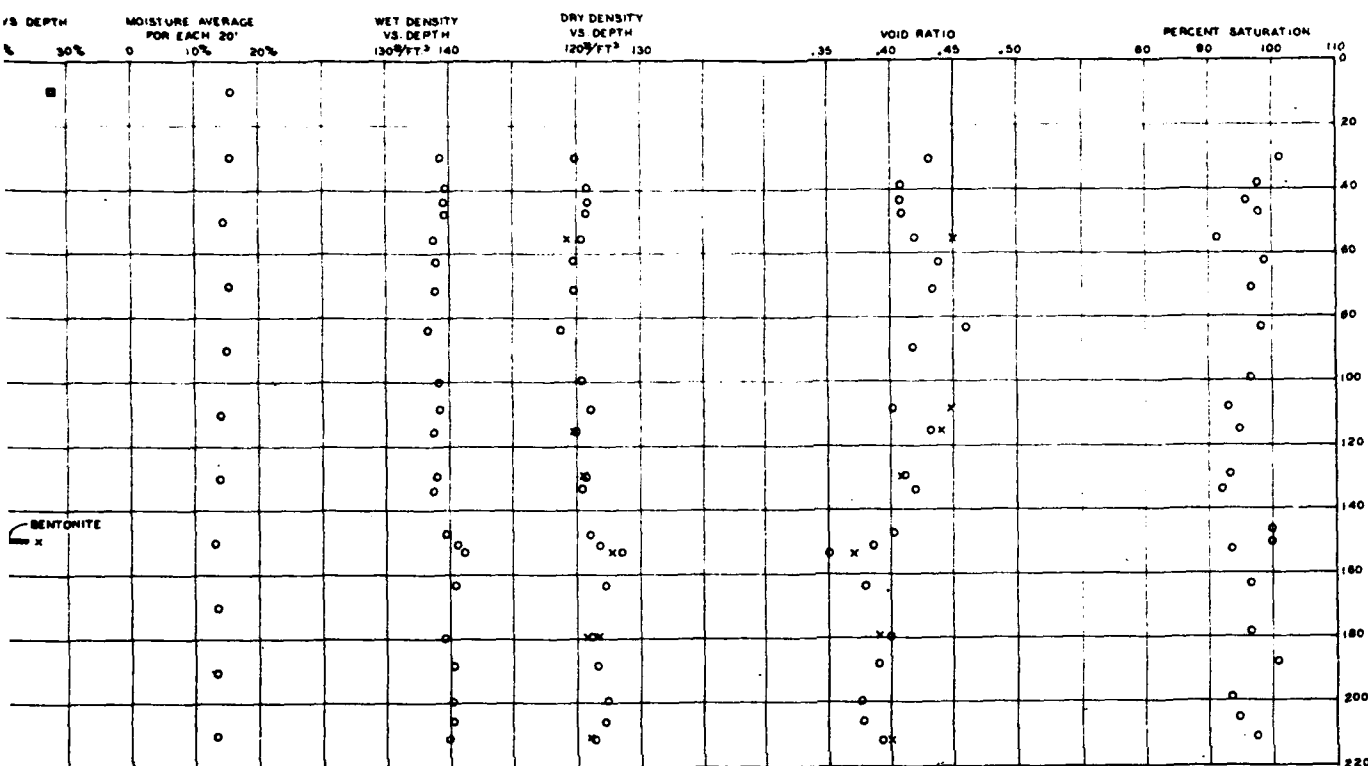
U. S. ARMY ENGINEER DISTRICT, SHAWA CORPS OF ENGINEERS SHAWA, NEBRASKA	
MISSOURI RIVER FORT PECK DAM AND RESERVOIR SPILLWAY REHABILITATION TILTMETER OBSERVATIONS STATION 40+00	
DATE OF SURVEY 1960	DATE OF REPORT SEPT 1960
BY [Signature]	BY [Signature]
FOR [Signature]	FOR [Signature]

CORPS OF ENGINEERS



KEY PLAN

THIS DRAWING HAS BEEN REDUCED TO
FOUR-FIFTHS THE ORIGINAL SCALE.



1 & X - VALUES NOT USED
IN 20' AVERAGES

NOTE:

X - CHECK VALUES DETERMINED FROM
LABORATORY ANALYSIS OF SAMPLES
DURING TESTING.

VOID RATIO AND PERCENT SATURATION DETERMINED
USING CONSTANT VALUE OF $G_s = 2.75$

LEGEND:

65-1



HOLE NUMBER
Asphalt & Gravel or
Weathered Shale

Bentonite
Slickensides
Joint
Lost Core
Concretions

No. indicates thickness
in feet.



THIS DRAWING HAS BEEN REDUCED TO
THREE-EIGHTHS THE ORIGINAL SCALE.

THIS PLAN ACCOMPANIES CONTRACT NO.
DA-36-000-0000 RECONSTRUCTION NO.

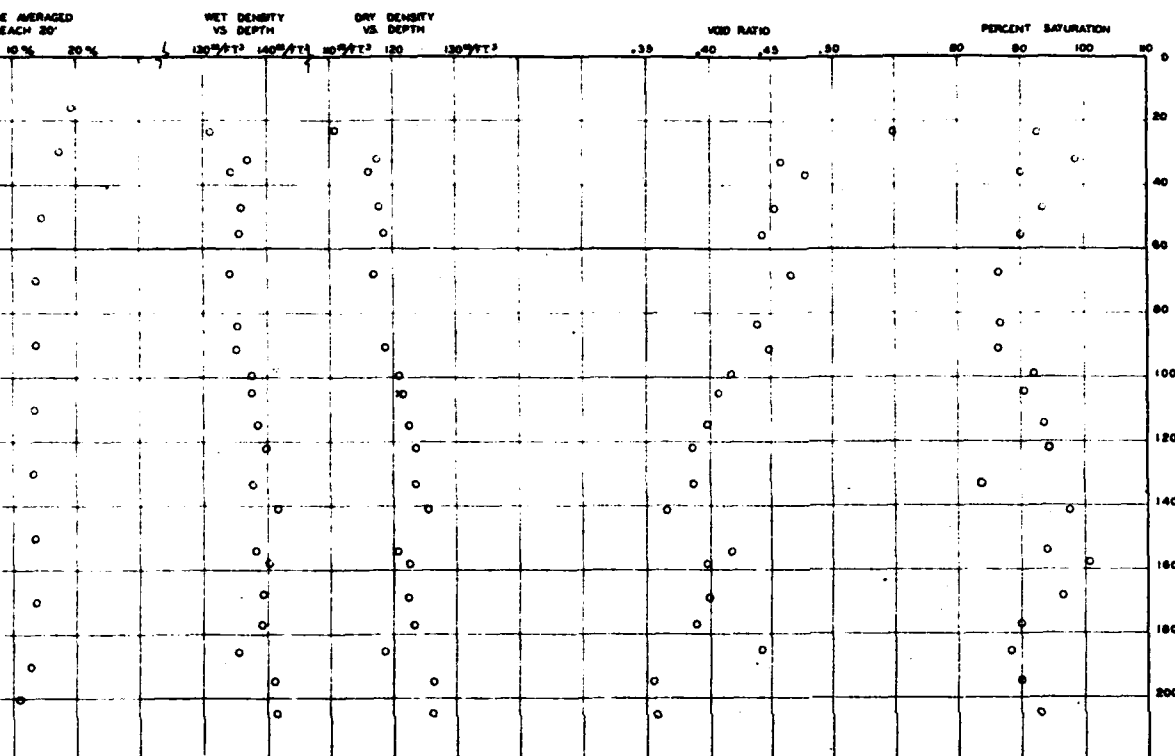
DATE		REVISION		PAGE		LARGE	
DESIGNED							
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA							
CHIEF OF DISTRICT				MISSOURI RIVER			
FORT PECK DAM AND RESERVOIR SPILLWAY REHABILITATION HOLE 65-1T MOISTURE, DENSITY, VOID RATIO AND PERCENT SATURATION				DATE			
APPROVED BY				DATE			
CHECKED BY				DATE			
DRAWN BY				DATE			
SCALE				DATE			

CONSTRUCTION FOUNDATION REPORT

PLATE 90

2

THIS DRAWING WAS THEN REDUCED TO
THREE-EIGHTH THE ORIGINAL SCALE



NOTE:
 1-CHECK VALUES DETERMINED
 FROM LABORATORY ANALYSIS
 OF SAMPLES DURING TESTING

VOID RATIO AND PERCENT SATURATION DETERMINED
 USING CONSTANT VALUE OF $G_s = 2.75$



LEGEND:

- 6-2
 1/2" HOLE NUMBER
 Asphalt & Gravel or
 Weathered Shale
 1/2" Bentonite
 Slickensides
 Joint
 Lost Core
 1/2" Concrete

1/2" No. indicates thickness
 in feet.

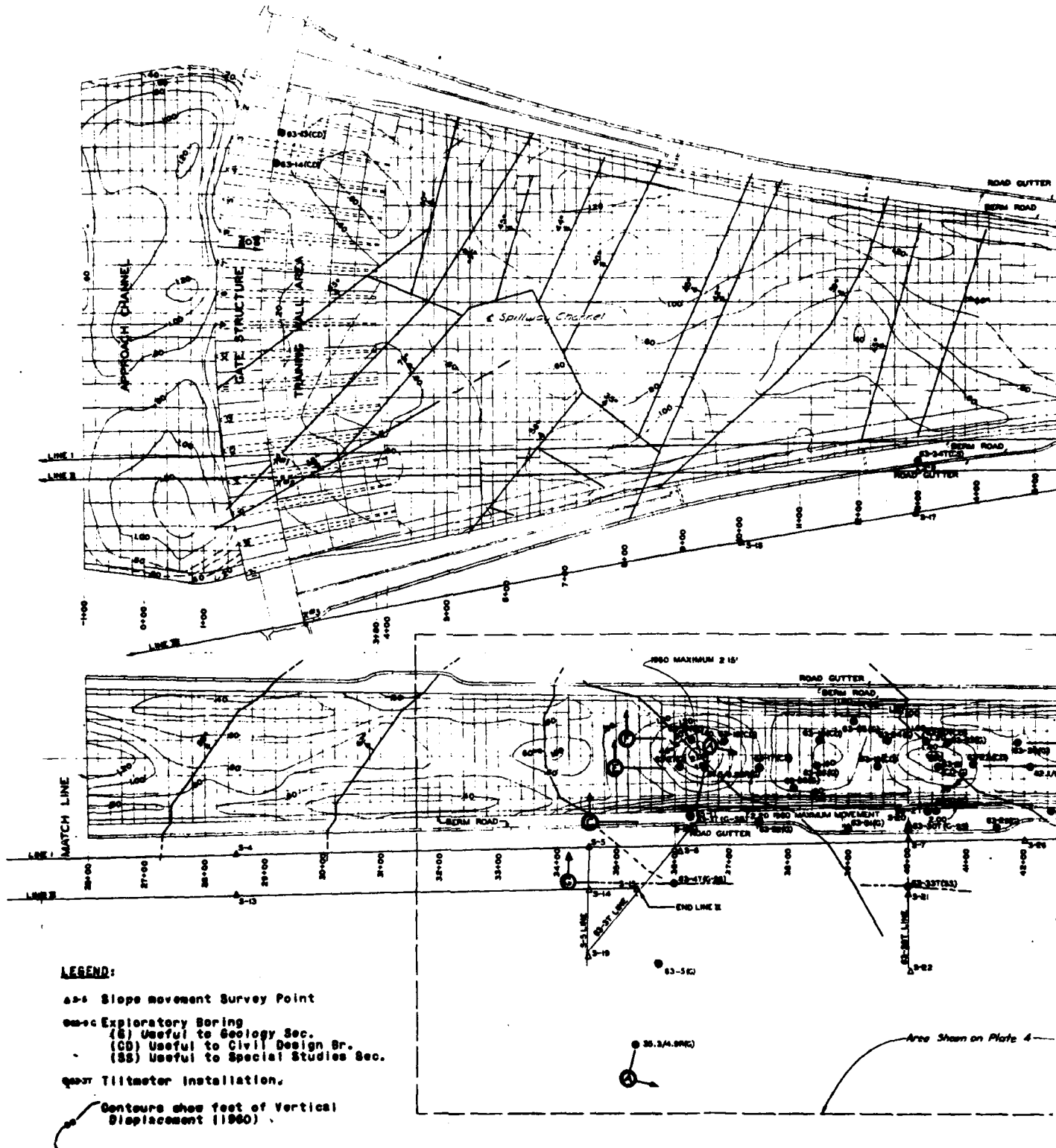


THIS DRAWING AND DATA SUBJECT TO
 1000-11-1000 THE DESIGNER'S SCALE.

THIS PLAN REPRESENTS SURFACE AND
 SUBSURFACE DATA.

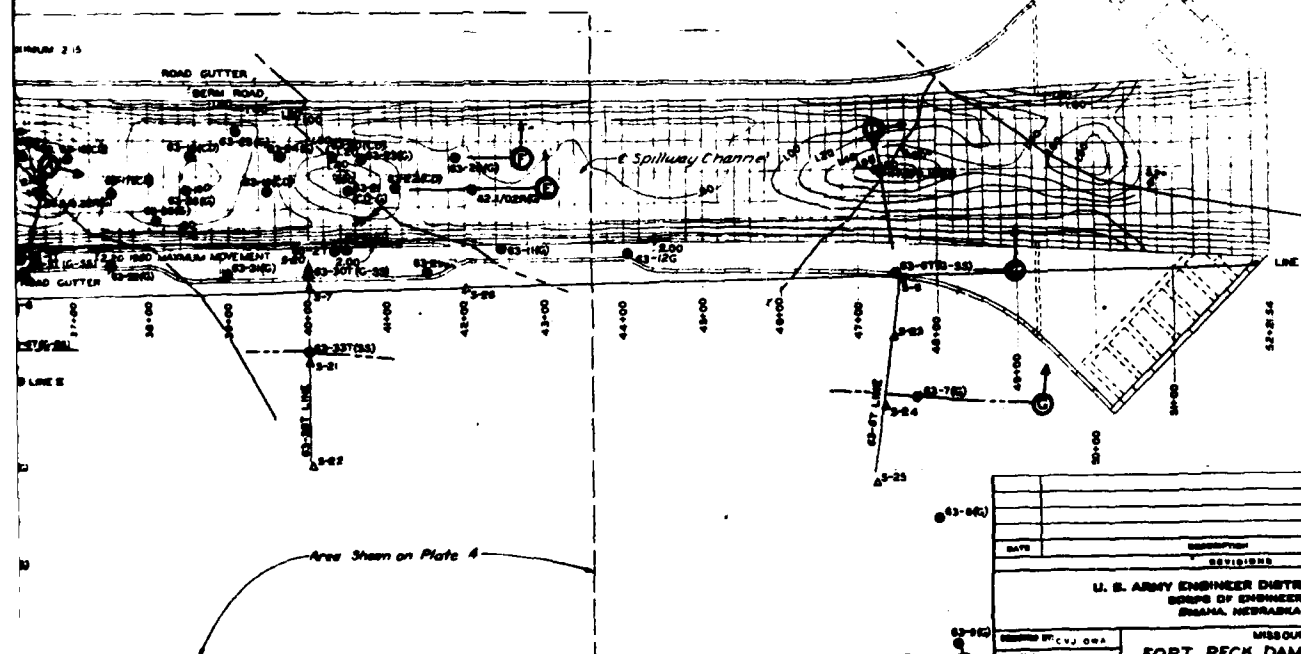
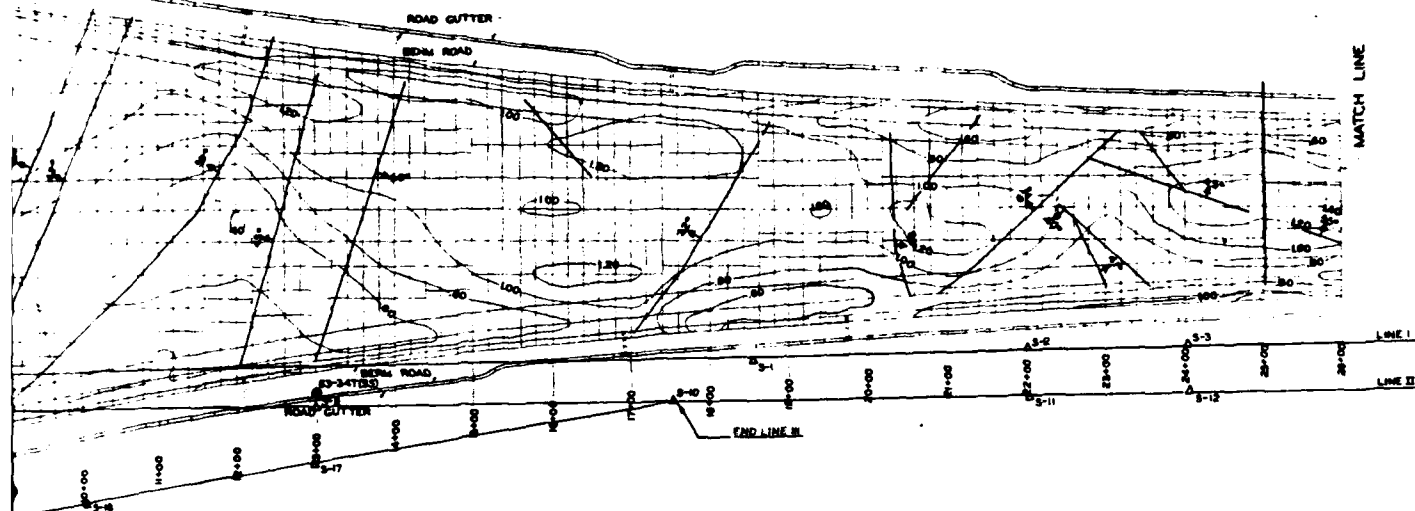
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA	
MISSOURI RIVER FORT PECK DAM AND RESERVOIR SPILLWAY REHABILITATION HOLE 65-2T MOISTURE, DENSITY, VOID RATIO AND PERCENT SATURATION	
DESIGNED BY: C. J. G. M.	DATE: DEPT 1966
CHECKED BY: P. E. R.	DATE: DEPT 1966
APPROVED BY: P. E. R.	DATE: DEPT 1966
DESIGNED BY: G. W. A.	DATE: DEPT 1966
 G. W. A.	

CORPS OF ENGINEERS



SCALE 1 INCH = 60 FEET

THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE.



SCALE 1 INCH = 50 FEET

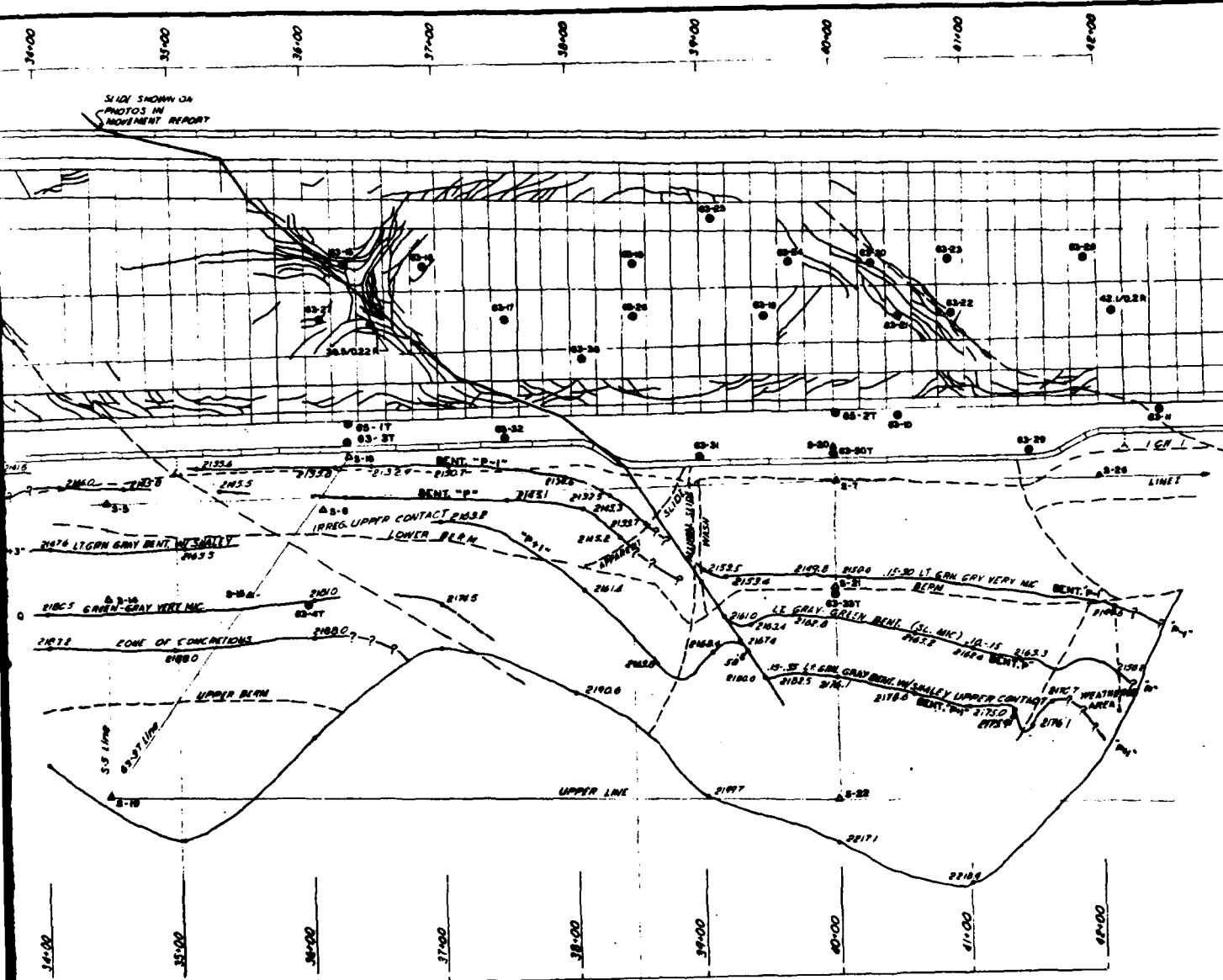


THIS PLAN ACCOMPANIES CONTRAST NO
 64-55-555-45 . REGISTRATION NO.

DATE	REVISIONS	SCALE	APPROVAL
	1		
<p align="center">U. S. ARMY ENGINEERING DISTRICT, OMAHA BUREAU OF ENGINEERS OMAHA, NEBRASKA</p>			
DESIGNED BY: <i>C. J. OWA</i> CHECKED BY: <i>R. G.</i> DRAWN BY: <i>R. G.</i> COUNCIL BY: <i>C. J. OWA</i> <i>FOR REVIEW</i> <i>FOR REVIEW</i>		MISSOURI RIVER FORT PECK DAM AND RESERVOIR SPILLWAY REHABILITATION PLAN OF BORINGS & SURFACE MOVEMENT POINTS	
APPROVED: <i>W. L. L...</i> SPECIAL AGENT IN CHARGE APPROVED: <i>Charles E. Hagg</i> CHIEF ENGINEER	DATE: SEPT 1955 SHEET NO. 1 OF 1	MADE AT: OMAHA DRAWN BY: W. L. L... CHECKED BY: W. L. L...	
<i>David J. de Clair</i> CHIEF OF DISTRICT ENGINEERS		SCALE: AS SHOWN DRAWING NUMBER: ...	

2

THIS DRAWING WAS ONLY REDUCED TO
THREE-EIGHTHS THE ORIGINAL SCALE.



CRACK SURVEY & SLOPE MAPPING
SCALE: 1 INCH = 40 FEET



U. S. ARMY ENGINEER DISTRICT, OMAHA GROUP OF ENGINEERS OMAHA, NEBRASKA	
PROJECT: FORT PECK DAM AND RESERVOIR SPILLWAY REHABILITATION CRACK SURVEY, SLOPE MAPPING AND GEOLOGIC COLUMN	
DESIGNED BY: F.A.S.	DRAWN BY: [Signature]
CHECKED BY: [Signature]	DATE: SEPT 1955
APPROVED BY: [Signature]	

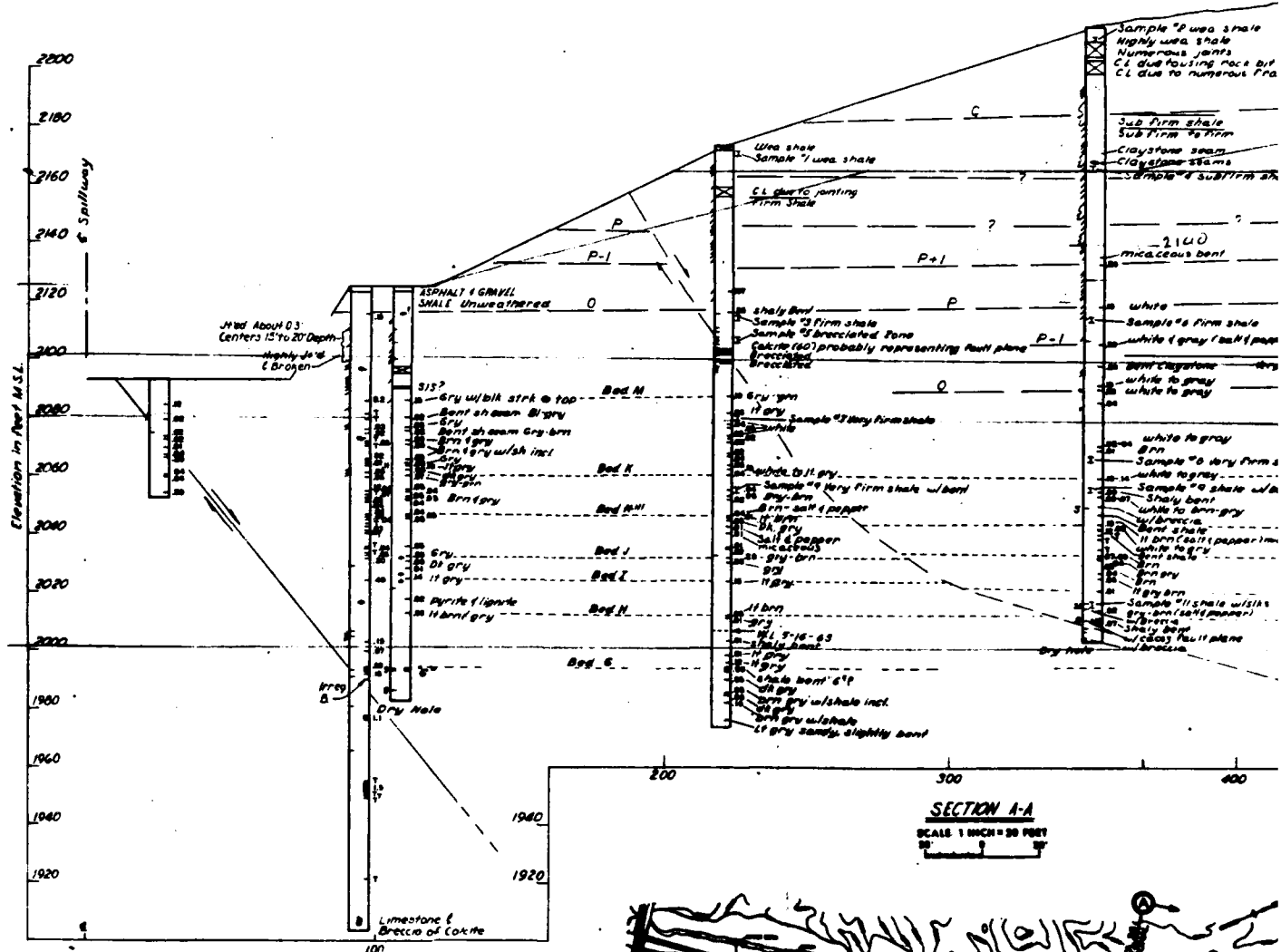
2

34.5/0.22R

60-IT 60-3

60-4

60-5



Dr. S. BODDING HAS BEEN REDUCED TO
FOOT-LENGTHS THE ORIGINAL SCALE.

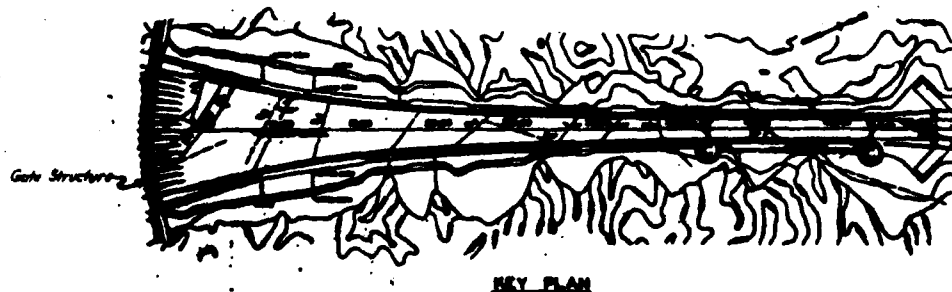
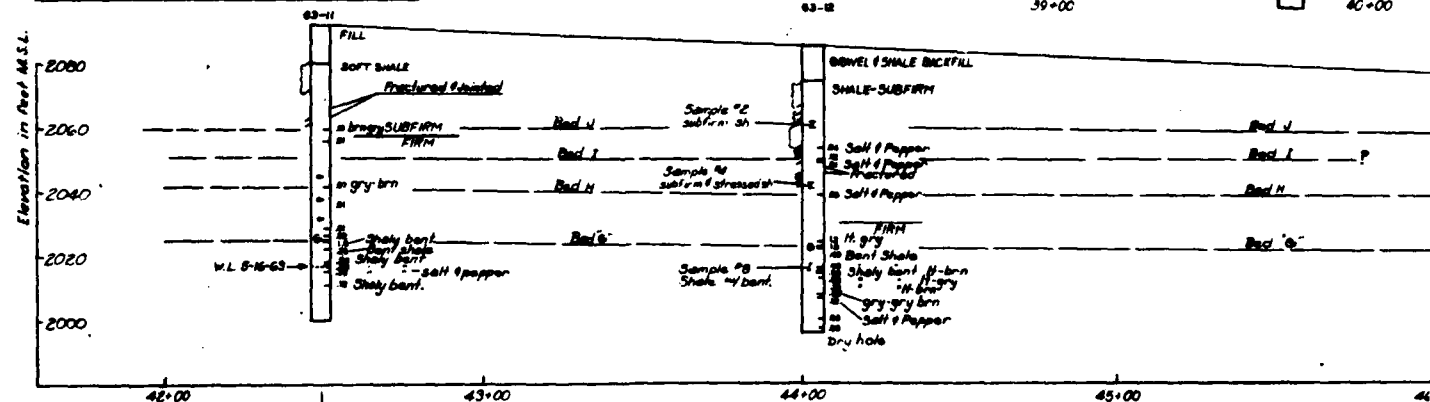
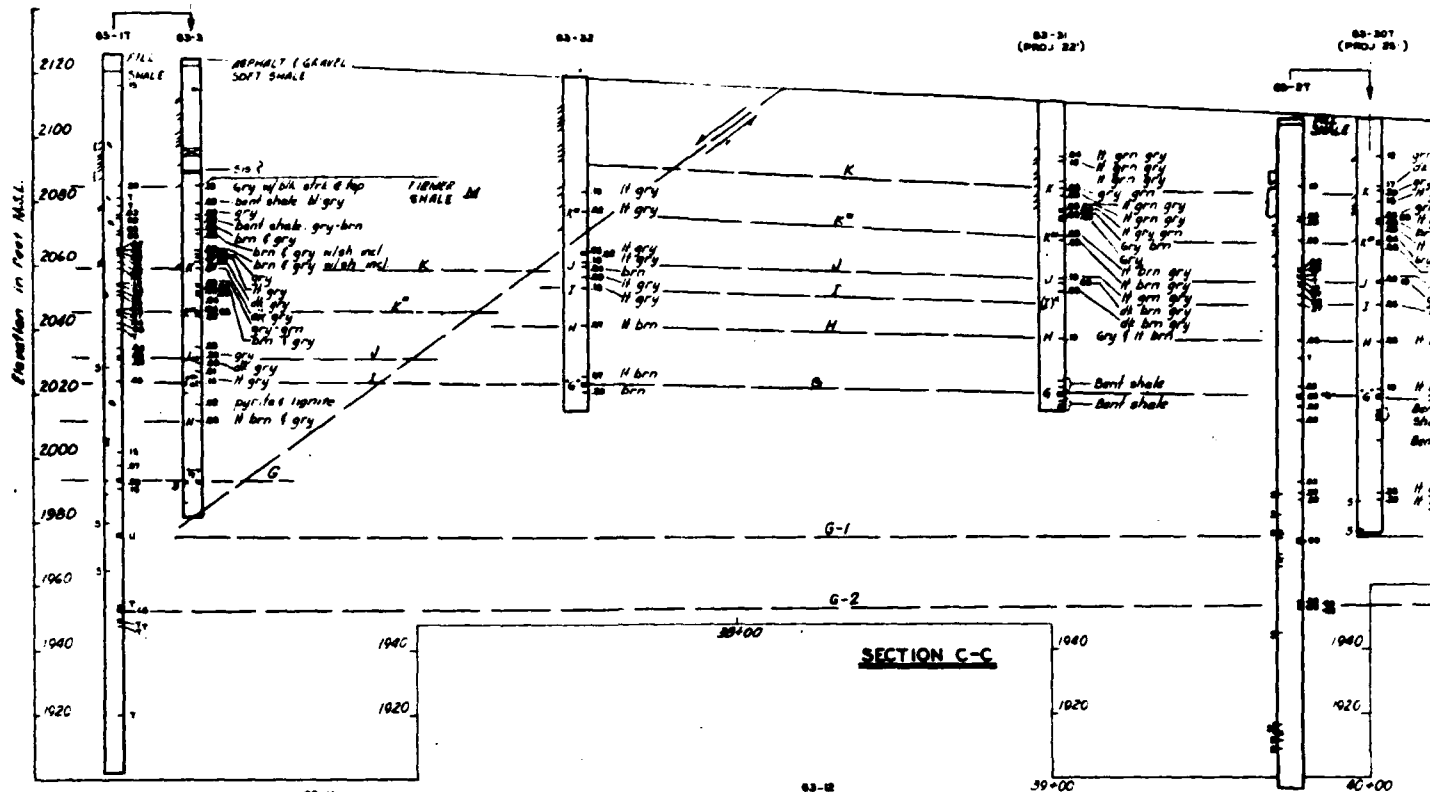


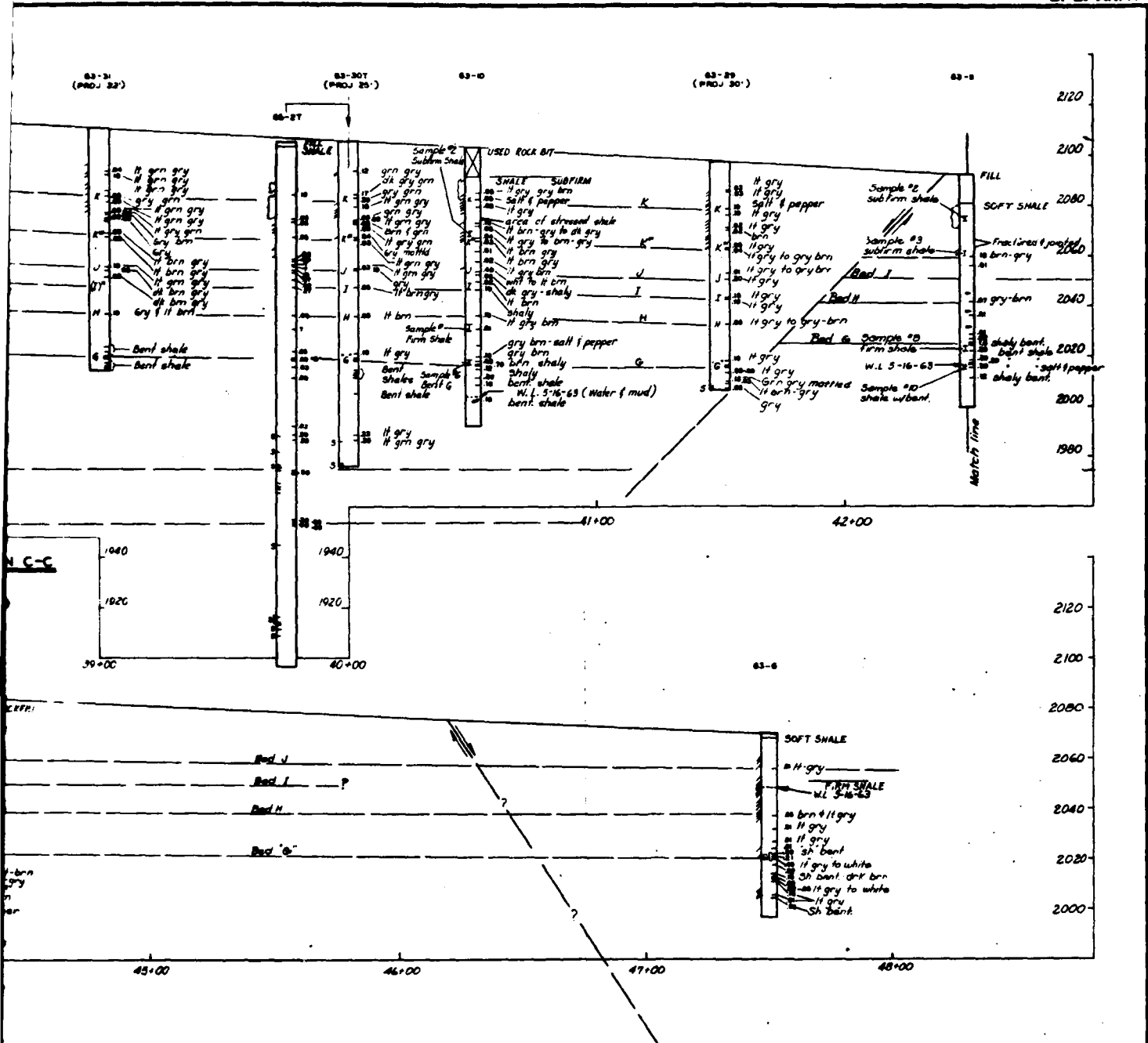
63-1 HOLE NO
Concrete
Best. pass shale
Bertramite seam
Stichenside
Joint
Lost core
Water level
Cementation



PLATE 94

CORPS OF ENGINEERS



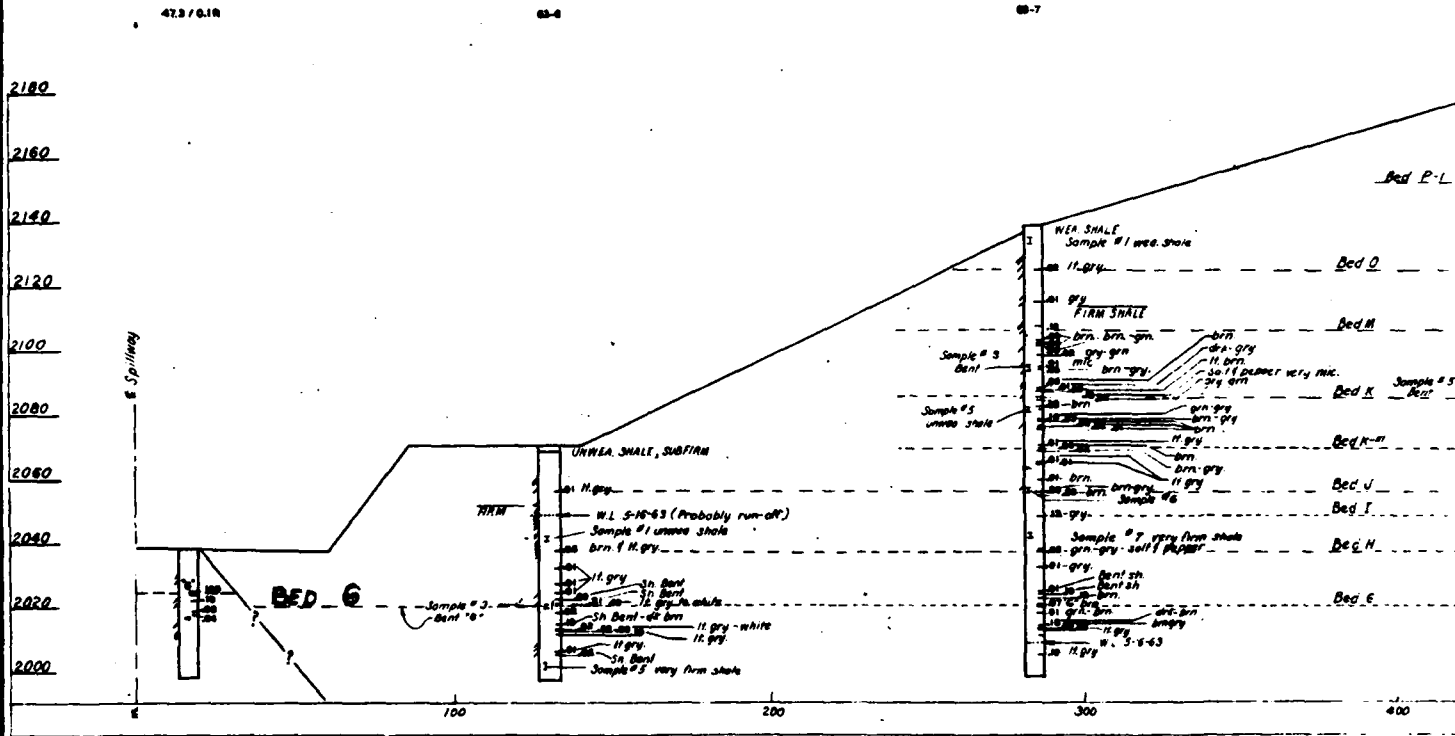


SECTION C-C (CONT'D)

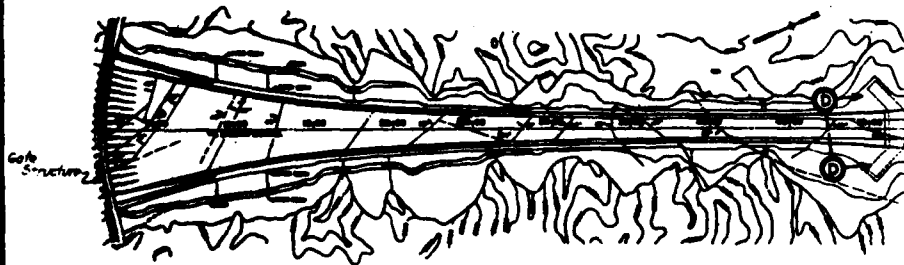
SCALE 1 INCH = 20 FEET



U. S. ARMY ENGINEER DISTRICT, OMAHA DIVISION OF ENGINEERING OMAHA, NEBRASKA	
MISSOURI RIVER FORT PECK DAM AND RESERVOIR SPILLWAY REHABILITATION GEOLOGICAL SECTION C-C	
DESIGNED BY: F.A.S.	DATE: DEPT. 1966
DRAWN BY: F.A.S.	CHECKED BY: [Signature]
APPROVED BY: [Signature]	DATE: [Date]



SECTION D-D
SCALE: 1 INCH = 50 FEET



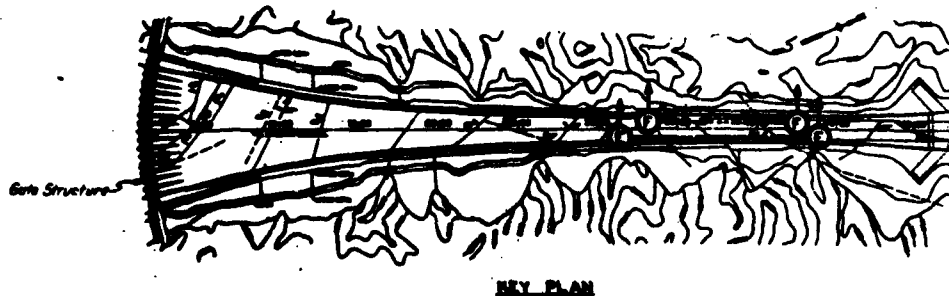
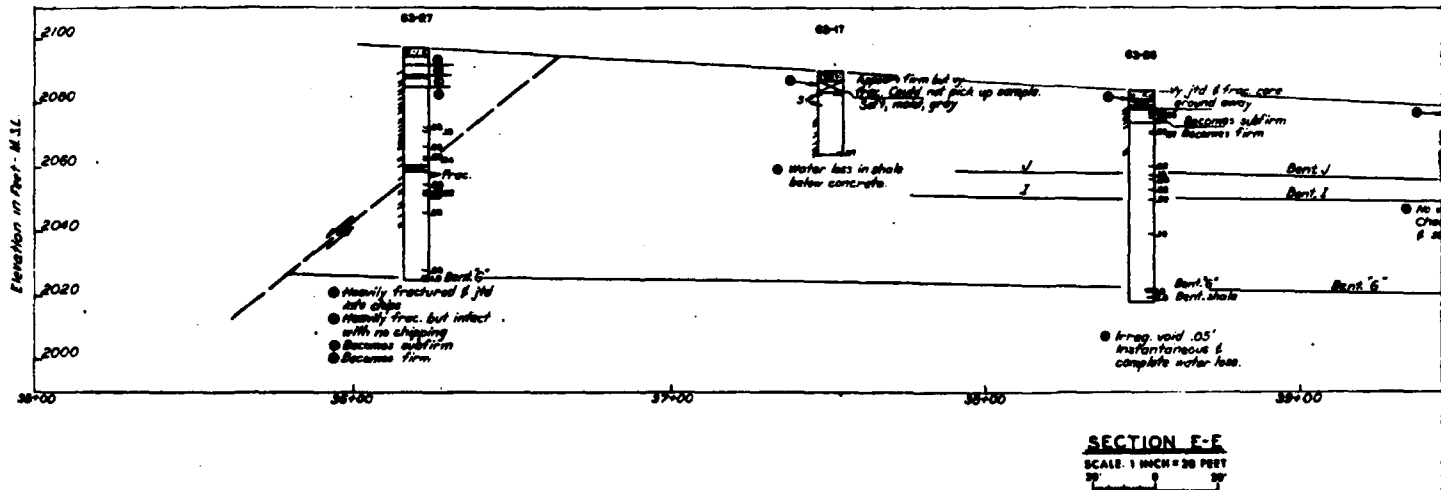
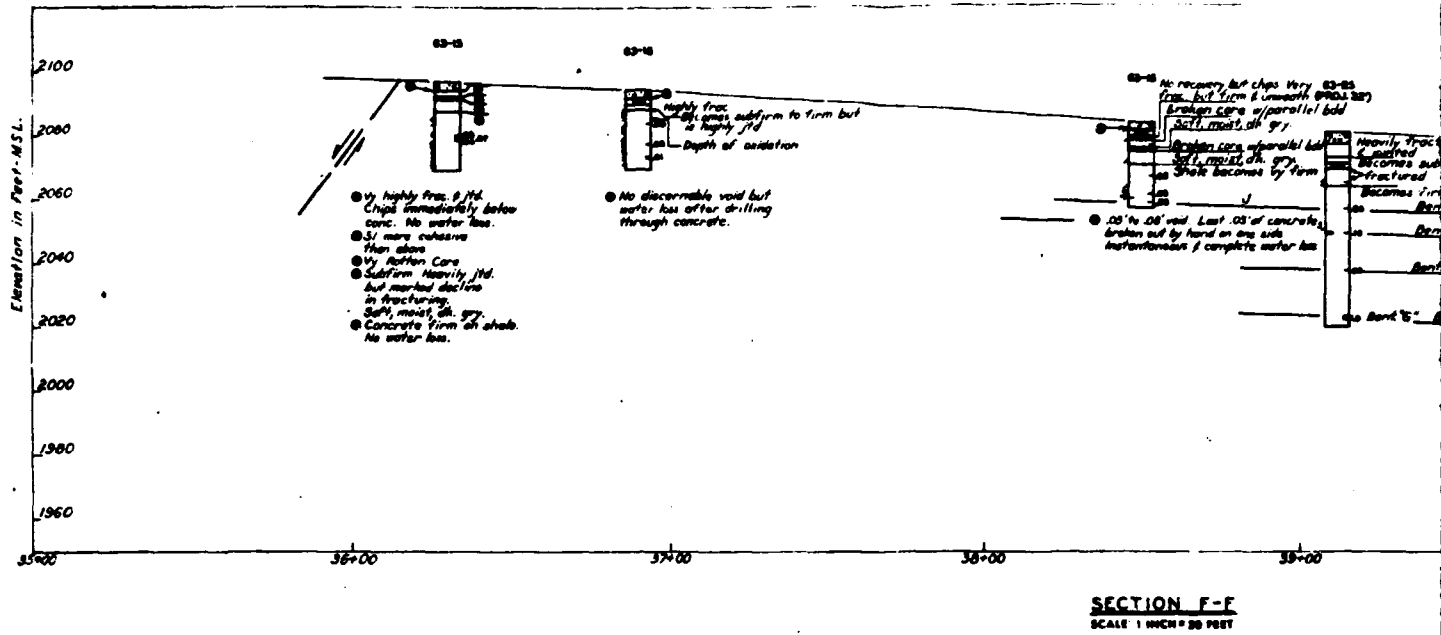


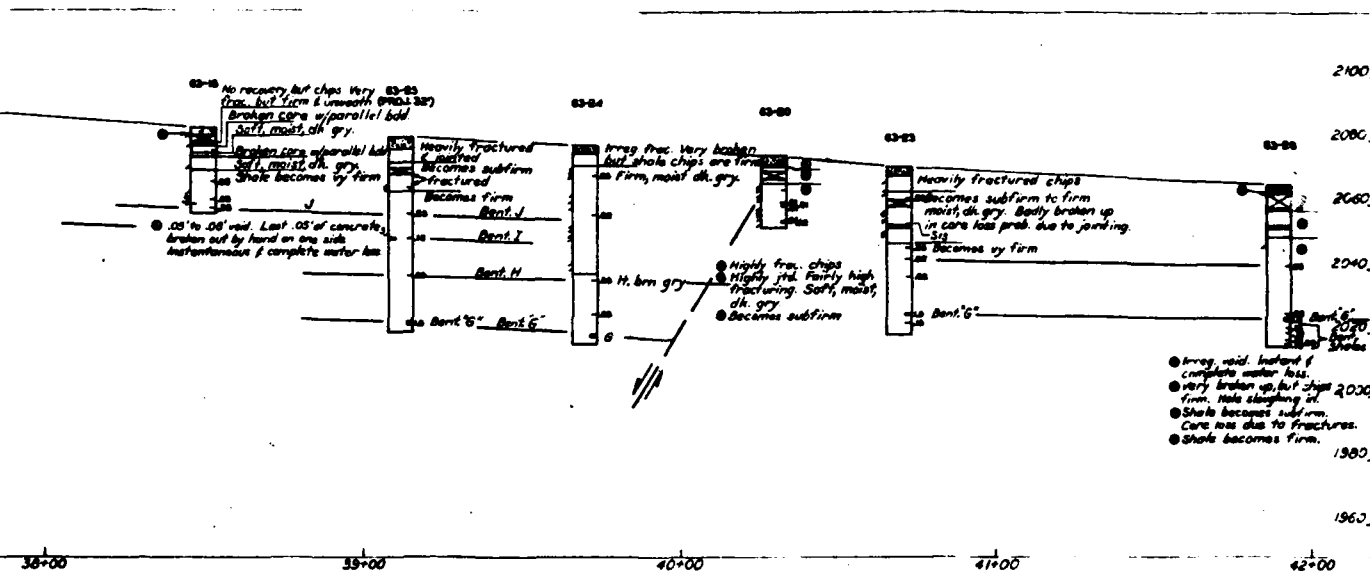
SCALE: 1 INCH = 30 FEET



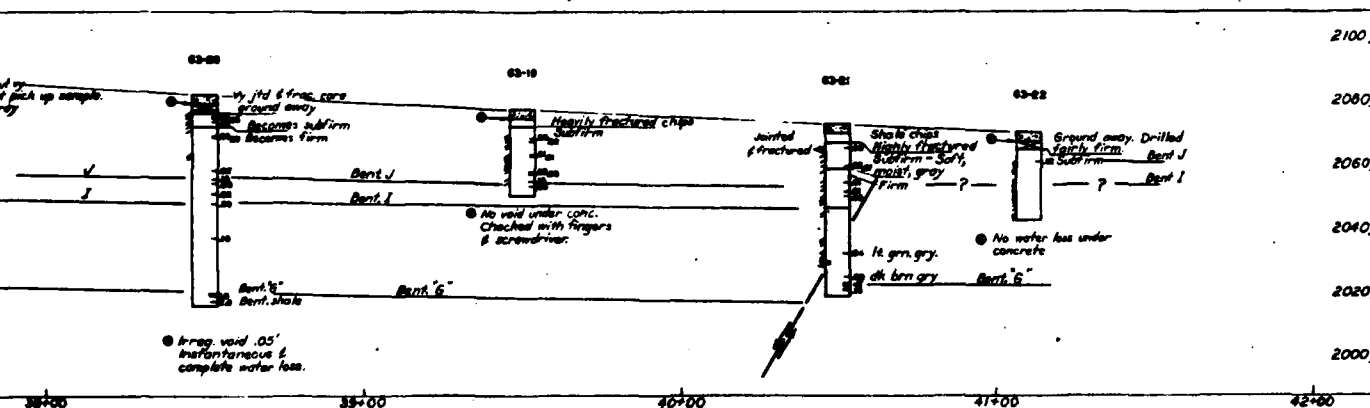
THIS PLAN ACCOMPANIES CONTRACT NO. 00-00-000-00. IDENTIFICATION NO.

DATE	DESCRIPTION			MADE	APPROVED
RECEIVED					
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA					
RECEIVED BY: P. A. B. DRAWN BY: CHECKED BY: DESIGNED BY: P. A. B. <i>THESE DRAWINGS</i> APPROVED: <i>[Signature]</i> SPECIAL AGENT IN CHARGE		MISSOURI RIVER FORT PECK DAM AND RESERVOIR SPILLWAY REHABILITATION GEOLOGIC SECTION D-D			
PROJECT: <i>St. Charles</i> DRAWN BY: <i>St. Charles</i> CHECKED BY: <i>St. Charles</i> APPROVED: <i>St. Charles</i>		DATE: <i>St. Charles</i> DRAWN BY: <i>St. Charles</i> CHECKED BY: <i>St. Charles</i> APPROVED: <i>St. Charles</i>		DATE: <i>St. Charles</i> DRAWN BY: <i>St. Charles</i> CHECKED BY: <i>St. Charles</i> APPROVED: <i>St. Charles</i>	





SECTION F-F
SCALE: 1 INCH = 30 FEET



SECTION E-E
SCALE: 1 INCH = 30 FEET



U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA	
MISSOURI RIVER FORT PECK DAM AND RESERVOIR SPILLWAY REHABILITATION GEOLOGIC SECTIONS E-E & F-F	
DESIGNED BY: F.A.S.	DATE: SEPT. 1955
DRAWN BY: F.A.S.	CHECKED BY: [Signature]
APPROVED BY: [Signature]	APPROVED BY: [Signature]
THIS PLAN REPRESENTS CURRENT DATA NO. 27-255-57	

2

Geological cross-section diagram showing rock strata, elevations, and stationing. The diagram includes labels for various geological units (P, P-1, O, M, K, J, I, H, G) and detailed descriptions of rock types and structures. Key features include a fault line, a brecciated zone, and a section of an observation pipe. The vertical axis shows elevation in feet (MSL) from 1920 to 2180. The horizontal axis shows stationing from 35+00 to 43+00.

Vertical Axis (Elevation in Feet - M.S.L.):

- 2180
- 2160
- 2140
- 2120
- 2100
- 2080
- 2060
- 2040
- 2020
- 2000
- 1980
- 1960
- 1940
- 1920

Horizontal Axis (Stationing):

- 35+00
- 36+00
- 37+00
- 38+00
- 39+00
- 40+00
- 41+00
- 42+00
- 43+00

Geological Units and Descriptions:

- P-3:** Thin Shale Sample, Thin Shale
- P-2:** C.L. Dip to Jointing Firm Shale
- P-1:** Thin Shale Sample, Brecciated Zone, Calcine (60) Probably Representing Fault Plane Brecciated
- O:** Conc. w/ Dull Scales Below
- M:** B. Sh. "Flecks"
- K:** B. Sh. "Flecks"
- J:** B. Sh. "Flecks"
- I:** B. Sh. "Flecks"
- H:** B. Sh. "Flecks"
- G:** B. Sh. "Flecks"

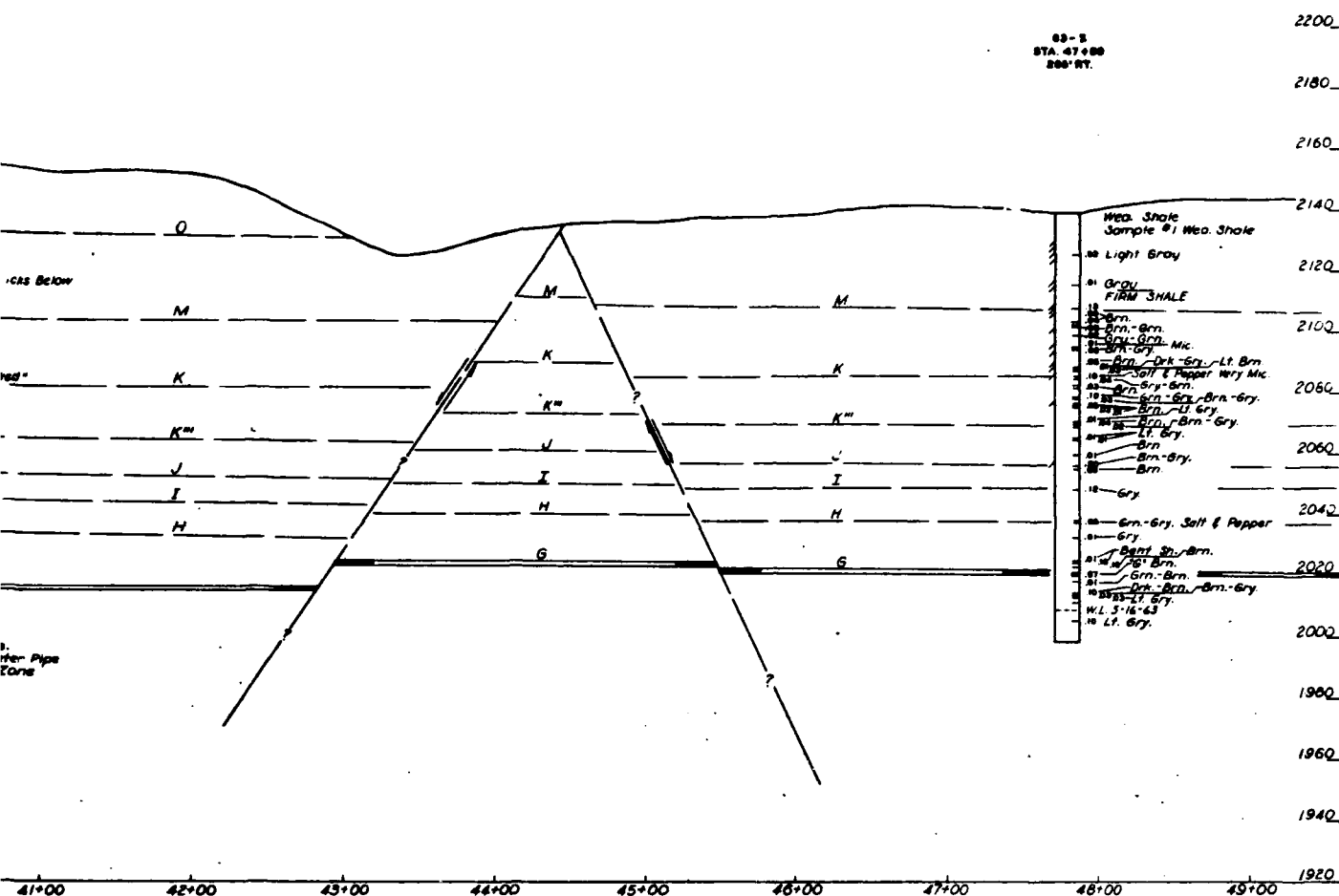
Other Labels:

- W.L. 5-10-53
- Shale Bent "B"
- Dark Gray
- Brown Gray W/ Shale Incl.
- Dark Gray
- Brown Gray W/ Shale
- Light Gray Sandy
- Slightly Bent
- Section of Obs. Section Tiltmeter Pipe
- B "Flecks" Zone

BRIDGE

SKETCH

THIS DOCUMENT HAS BEEN REPRODUCED TO
 SHOW-EXACTLY THE ORIGINAL PAGE.



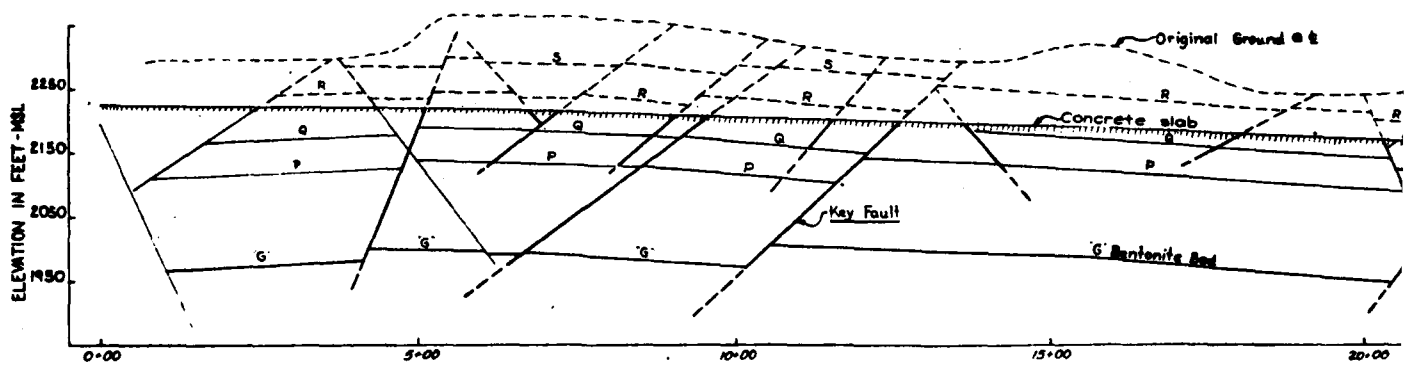
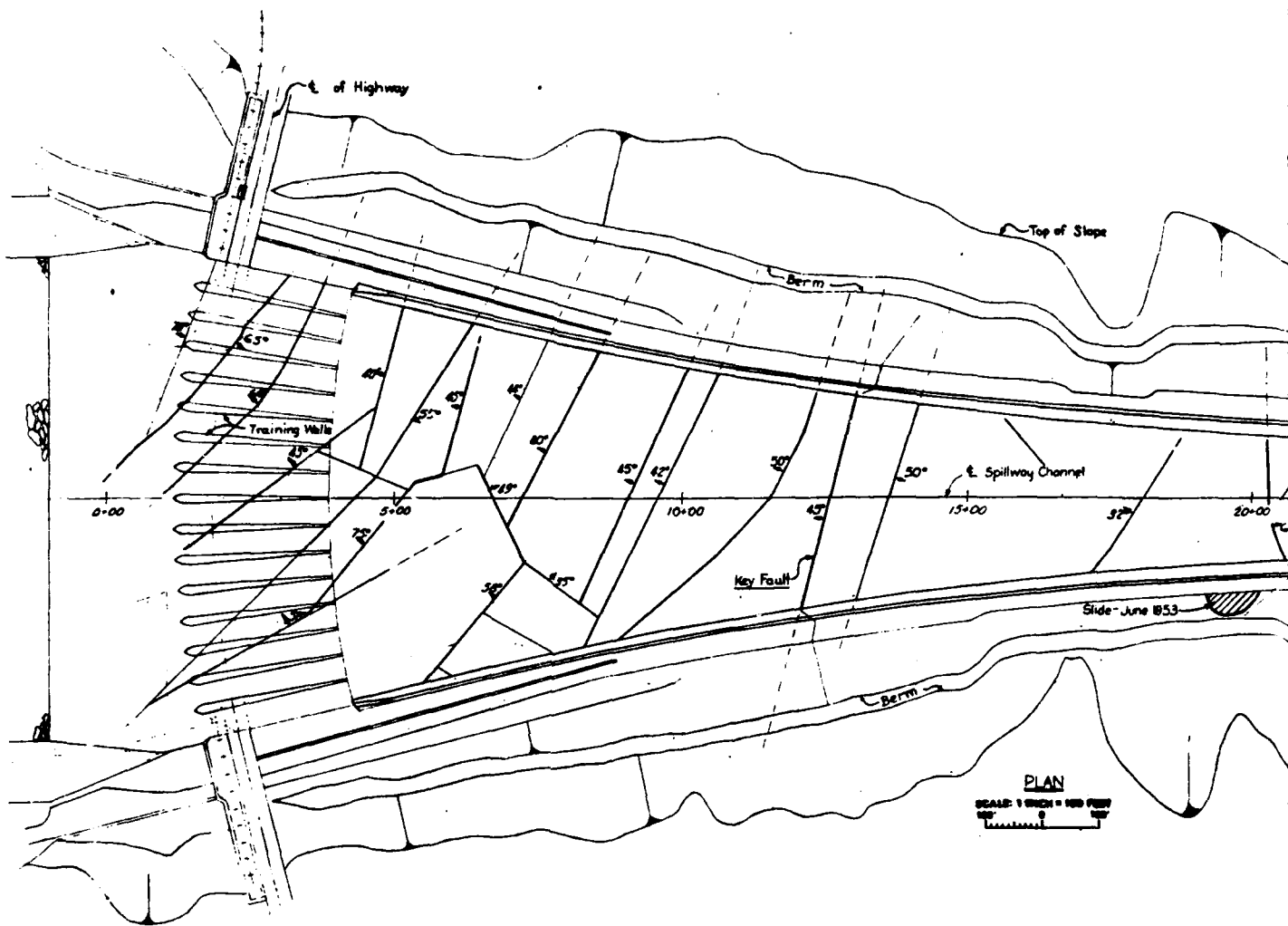
SECTION 6-6

SCALE: VERT 1 INCH = 20 FEET
HORIZ 1 INCH = 40 FEET



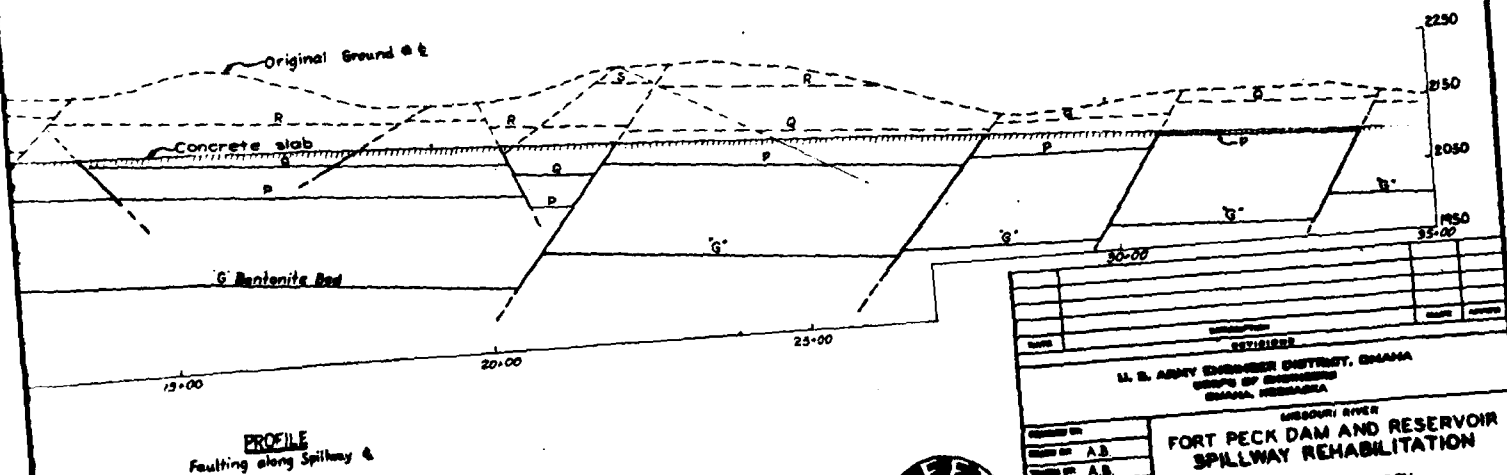
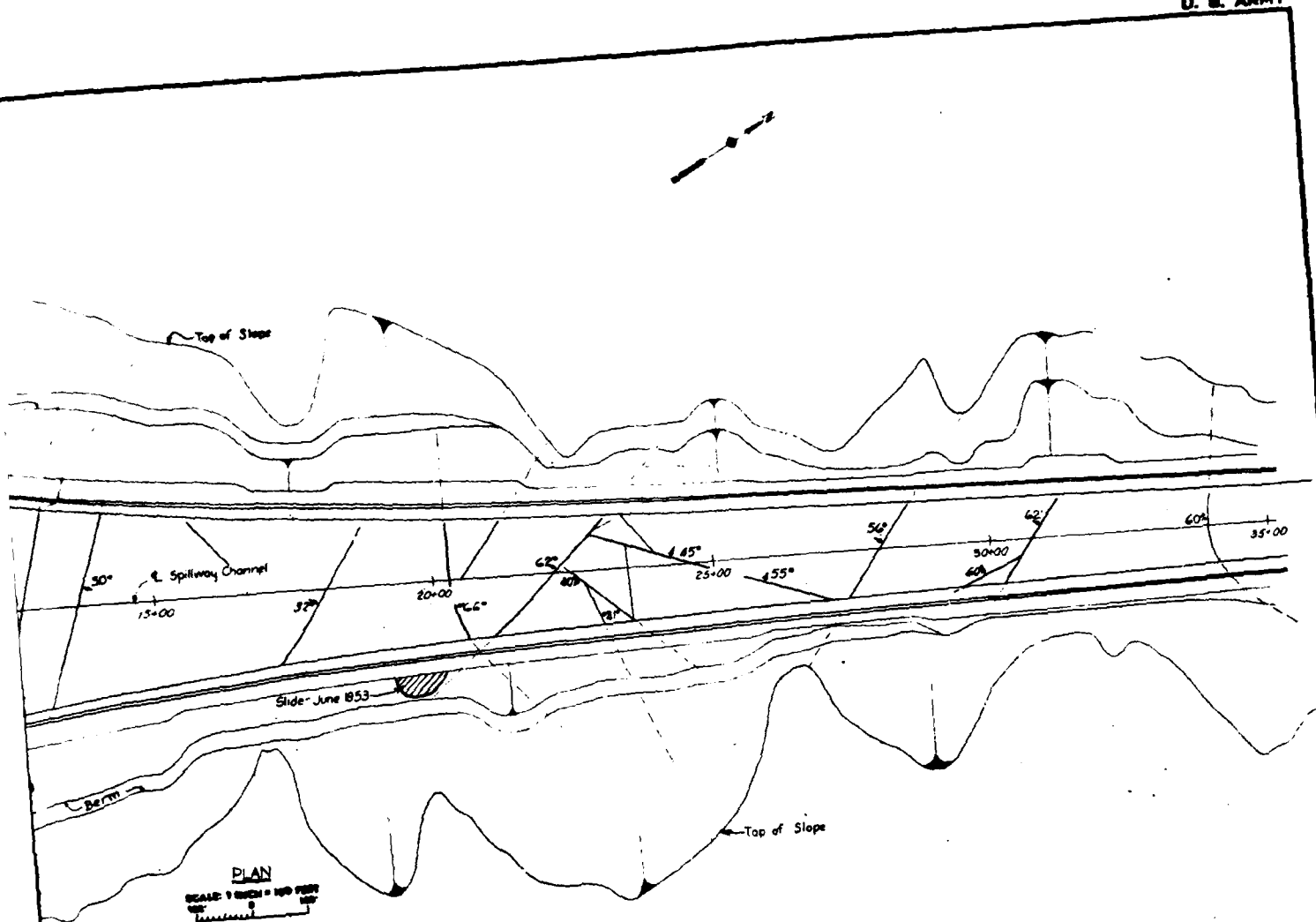
DATE		DIVISION		DATE	AMOUNT
U. S. ARMY ENGINEER DISTRICT, OMAHA GROUP OF ENGINEERS OMAHA, NEBRASKA					
MISSOURI RIVER FORT PECK DAM AND RESERVOIR SPILLWAY REHABILITATION GEOLOGIC SECTION G-G					
ISSUED BY: F. A. J.					
CHECKED BY: L. M. G.					
DRAWN BY: L. M. G.					
REVIEWED BY: F. A. J.					
DATE: 10/1/50		BY: [Signature]		DATE: SEPT. 1950	
FOR: [Signature]		MADE IN U.S.A.		GEO. ENG. DIST. OMAHA	
[Signature]				[Signature]	

CORPS OF ENGINEERS



PROFILE
Faulting along Spillway &

THIS DRAWING HAS BEEN REDUCED TO
THREE-FOURTHS THE ORIGINAL SCALE.



U. S. ARMY ENGINEER DISTRICT, CHAMPAIGN GROUP OF ENGINEERS CHAMPAIGN, ILLINOIS	
MISSOURI RIVER FORT PECK DAM AND RESERVOIR SPILLWAY GEOLOGY STA. 0+00 THROUGH 35+00	
DESIGNED BY: A.B. CHECKED BY: A.B. DRAWN BY: O.H.A. DATE: 10/1/54	DATE: 10/1/54 DRAWN BY: [Signature] CHECKED BY: [Signature]

THIS PLAN AND SPECIFICATIONS FOR THE
 CONSTRUCTION OF THE
 DAM AND RESERVOIR

CONSTRUCTION FOUNDATION REPORT

2 PLATE 99

DRAWING HAS BEEN REDUCED TO
 1/2 INCHES FOR ORIGINAL SCALE

Original To

ROAD GUTTER

ROAD

ROAD GUTTER

ROAD

MAXIMUM 2.15

Side-May 1965

PLAN

SCALE 1 INCH = 80 FEET

80' 0' 80'

ELEVATION IN FEET - MSL

120.0

100.0

100.0

26+00 Stationing

32+00

38+00

40+00

Top of Road

Center of Road

PROFILE

Faulting along Spillway 1

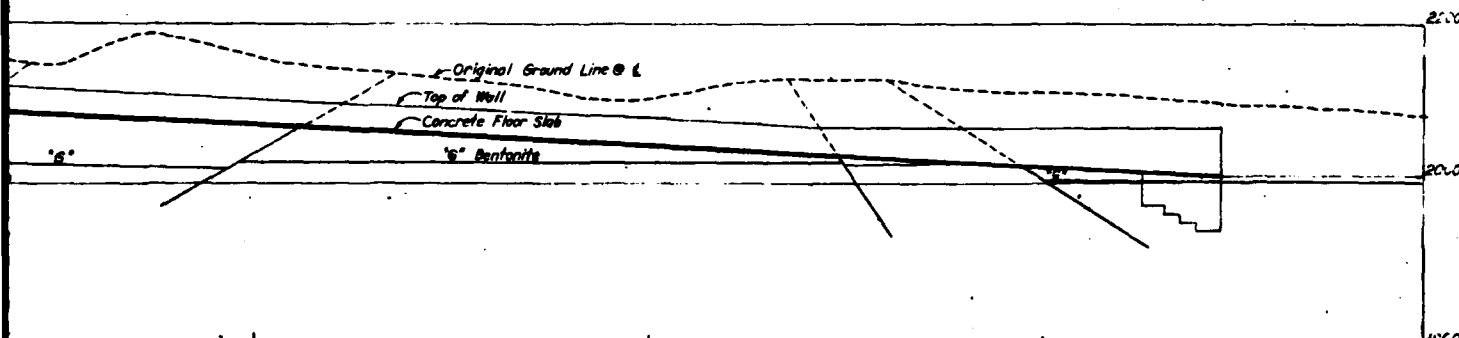
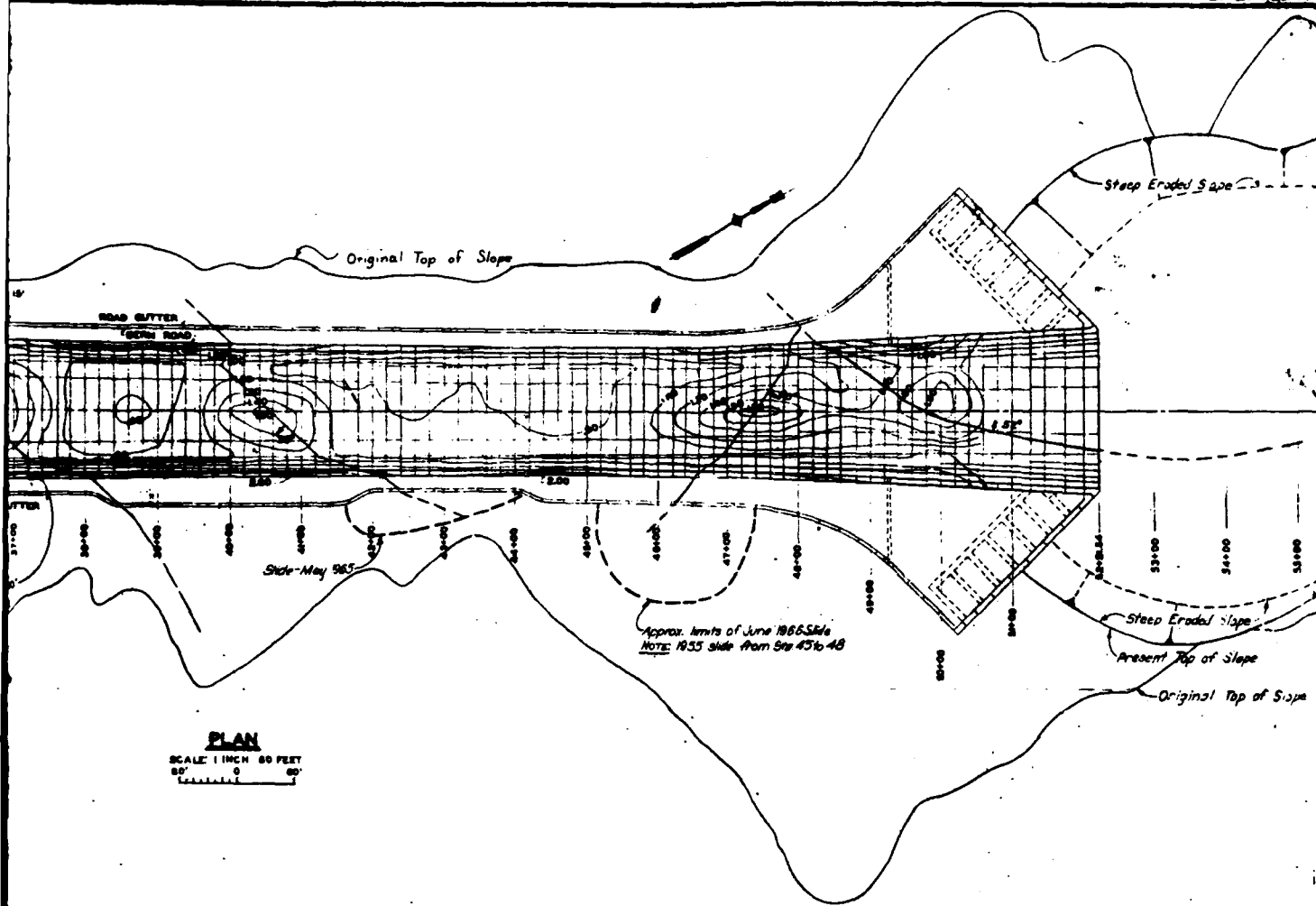
LEGEND

1-1

THIS DRAWING HAS BEEN REDUCED TO
THREE-FOURTHS THE ORIGINAL SCALE.

4

THIS DRAWING HAS BEEN REDUCED TO
THREE-EIGHTHS THE ORIGINAL SCALE



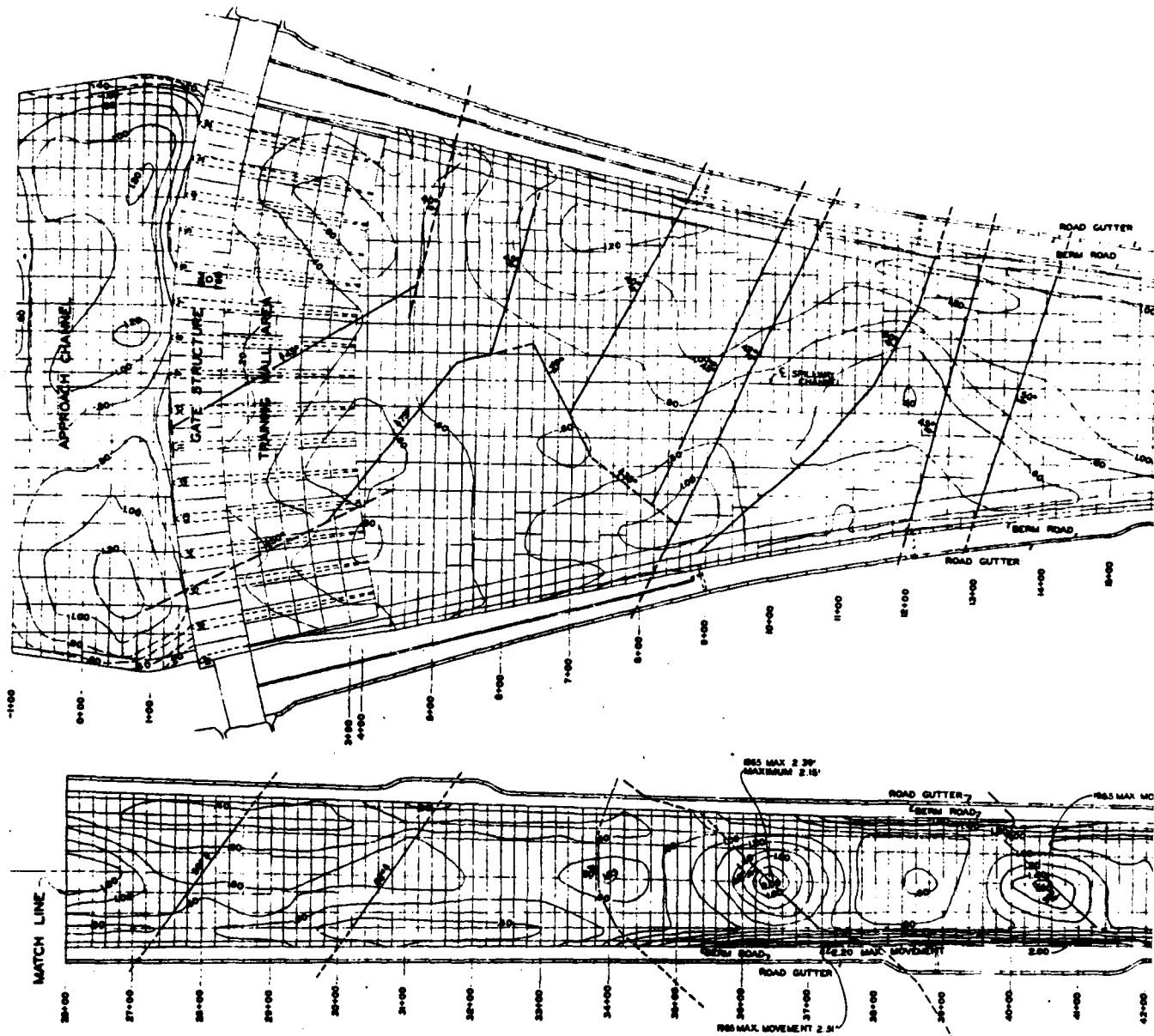
PROFILE
Faulting along Spillway L

LEGEND:
 "g" Bentonite marker bed
 Fault showing direction and amount of dip
 Contours show feet of vertical displacement (1960)



U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA	
MISSOURI RIVER FORT PECK DAM AND RESERVOIR SPILLWAY REHABILITATION SPILLWAY GEOLOGY STATION 28+00 TO 29+00	
DESIGNED BY CHECKED BY DRAWN BY IN CHARGE	DATE REVISIONS DATE REVISIONS
DESIGNED BY: <i>[Signature]</i> CHECKED BY: <i>[Signature]</i> DRAWN BY: <i>[Signature]</i> IN CHARGE: <i>[Signature]</i>	
DATE: <i>[Date]</i> REVISIONS: <i>[Date]</i> DATE: <i>[Date]</i> REVISIONS: <i>[Date]</i>	

2

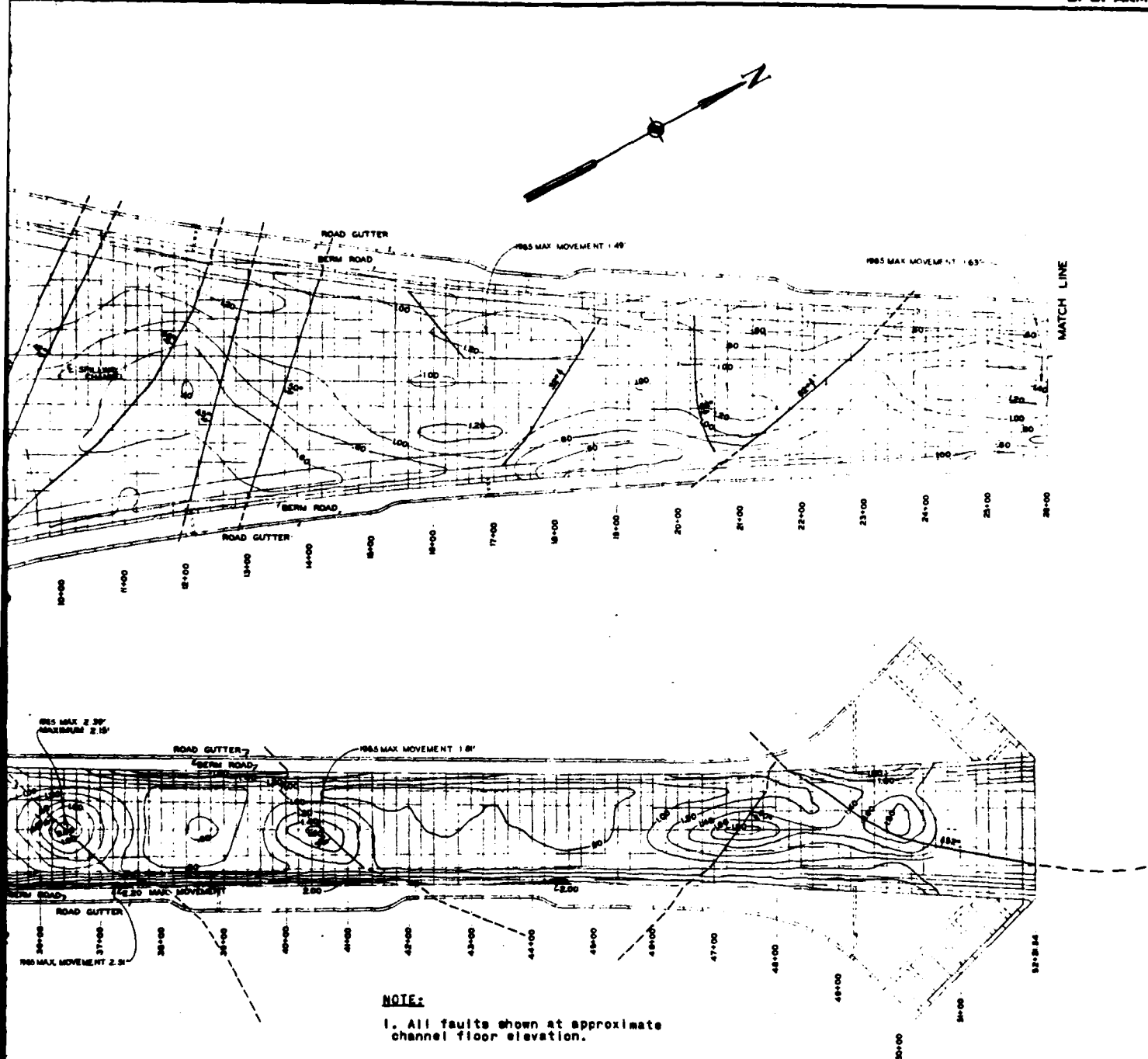


NOTE

1. A
chs

LEG

21
2



NOTE:

1. All faults shown at approximate channel floor elevation.

LEGEND:

- Fault showing direction and amount of dip.
- Contours show feet of vertical displacement (1960)

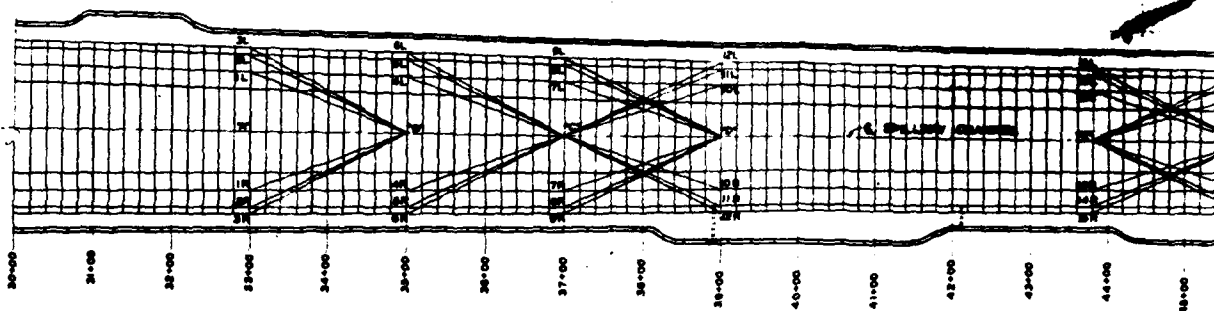
SCALE: 1 INCH = 50 FEET



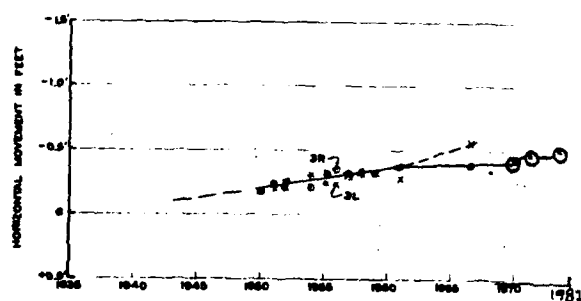
THIS PLAN ACCOMPANIES CONTRACT NO. 22-000-00000-00000
MODIFICATION NO.

DATE		REVISION		PAGE		SHEET	
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA							
MISSOURI RIVER FORT PECK DAM AND RESERVOIR SPILLWAY REHABILITATION VERTICAL DISPLACEMENT CONTOURS NOVEMBER 1960							
DESIGNED BY: C. J. D. A.	CHECKED BY: A. J. C.	DESIGNED BY: A. J. C.	CHECKED BY: A. J. C.	DESIGNED BY: A. J. C.	CHECKED BY: A. J. C.	DESIGNED BY: A. J. C.	CHECKED BY: A. J. C.
APPROVED BY: <i>Charles R. Fopp</i>				DATE: SEPT 1960			
APPROVED BY: <i>Harold J. de Clau</i>				DATE: SEPT 1960			

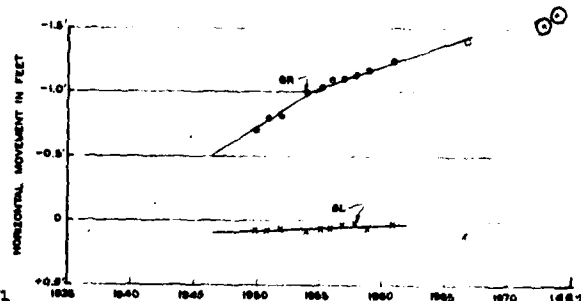
CORPS OF ENGINEERS



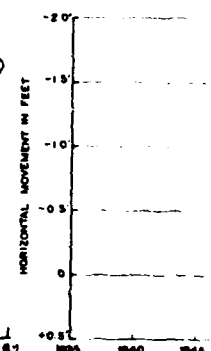
PLAN
SCALE 1 INCH = 50 FEET



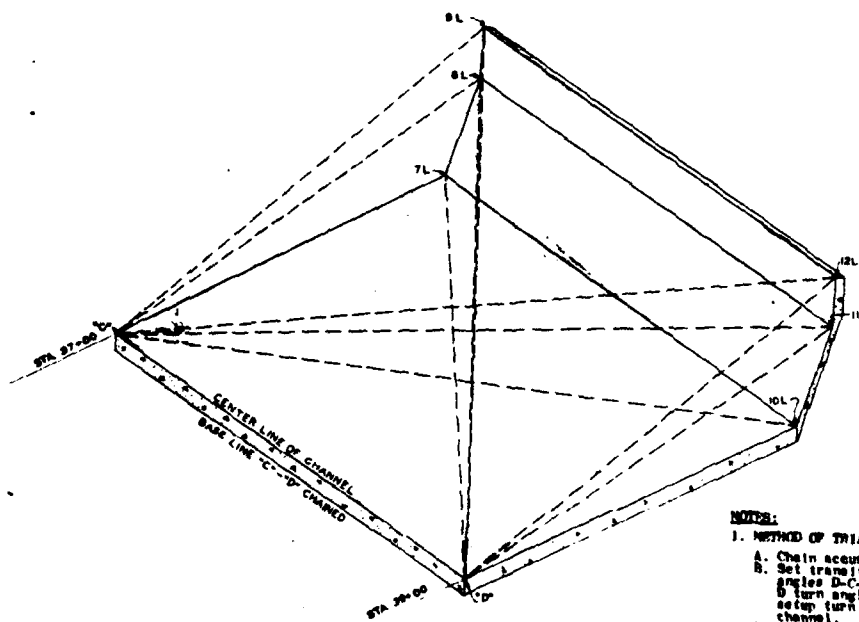
STA 33+00
SECTION A-POINTS 3R & 3L



STA 35+00
SECTION B-POINTS 5R & 5L



SECTION C



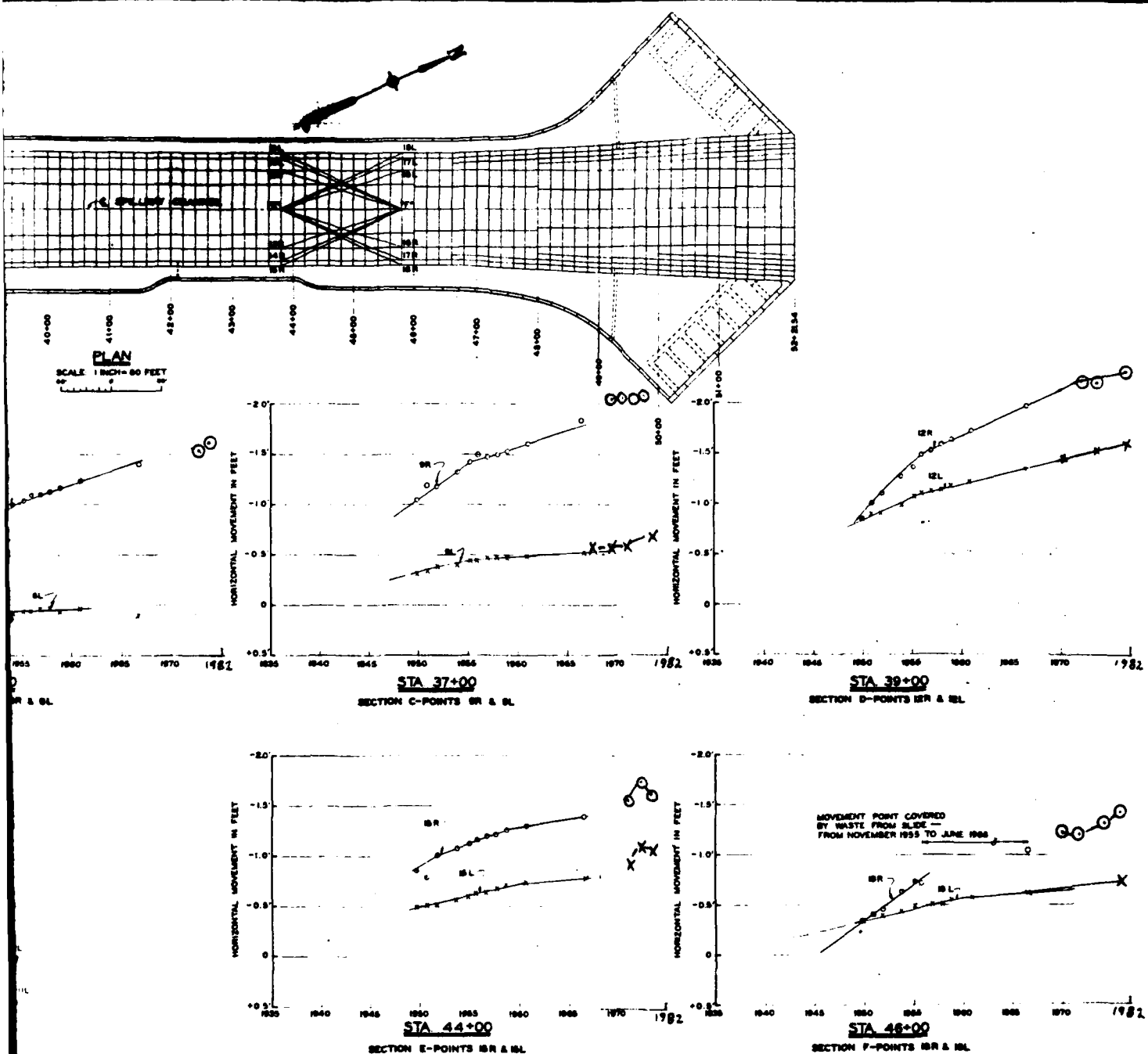
DETAIL
ISOMETRIC VIEW OF LEFT SIDE OF SHILAY
CHANNEL BETWEEN STA. 37+00 & STA. 39+00
SHOWING METHOD OF TRIANGULATION

NOTES:

1. METHOD OF TRIANGULATION:

- Chain accurately base line C-D.
 - Set transit on point C, backsight in point D, then turn angles D-C-7L; D-C-8L; D-C-9L again backsighting to point D turn angles D-C-10L; D-C-11L and D-C-12L. During same setup turn the corresponding angles on the right side of channel.
 - Set transit at point D, backsight in point C and turn angles C-D-10L; C-D-11L; C-D-12L; likewise turn angles C-D-7L; C-D-8L; C-D-9L and corresponding angles on right side of channel from same setup.
 - Each angle must be doubled and average reading recorded.
2. Movement shown by graphs is change in distance (shortening) between wall points on right & left side of the channel.

THIS DRAWING HAS BEEN REDUCED TO
THREE-EIGHTHS THE ORIGINAL SCALE.



ANGULATION:

Traverse line C-D. If on point C, backsight in point D, then turn 90° left, D-C-90L; D-C-90L again backsighting to point D, D-C-180L; D-C-180L and D-C-180L. During some of the corresponding angles on the right side of the channel. If at point D, backsight in point C and turn 90° left, C-D-90L; C-D-90L; likewise turn angle 90° left, C-D-90L and corresponding angles on right side of the channel. All angles must be double checked and average reading recorded. In any graphs to change in distance (shortening) points on right & left side of the channel.

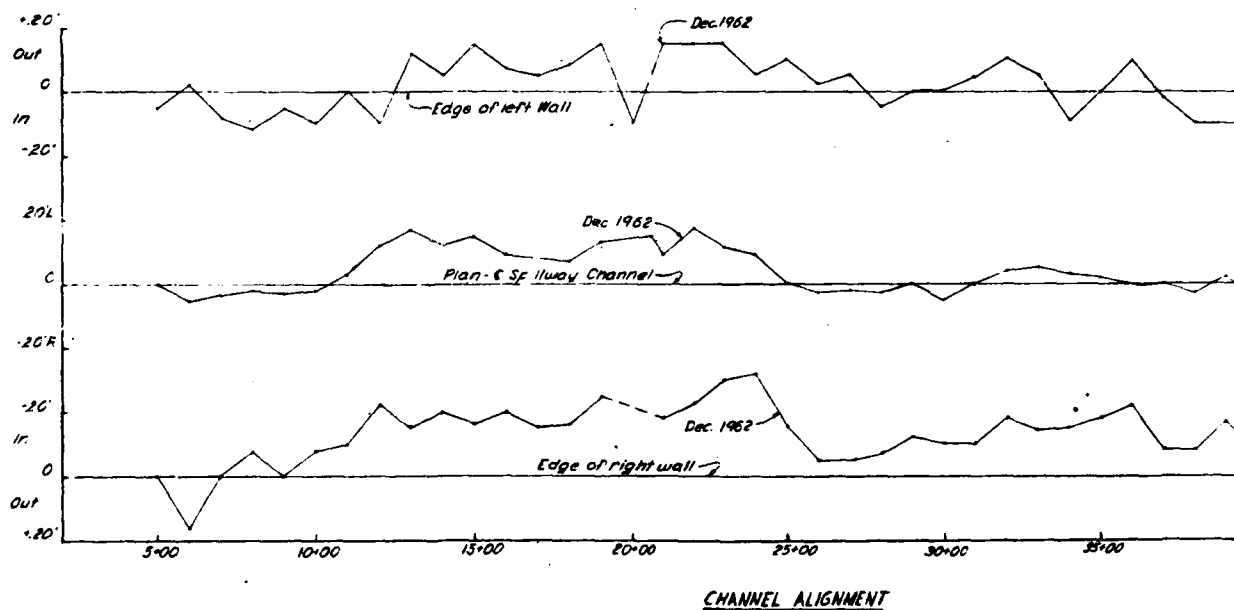
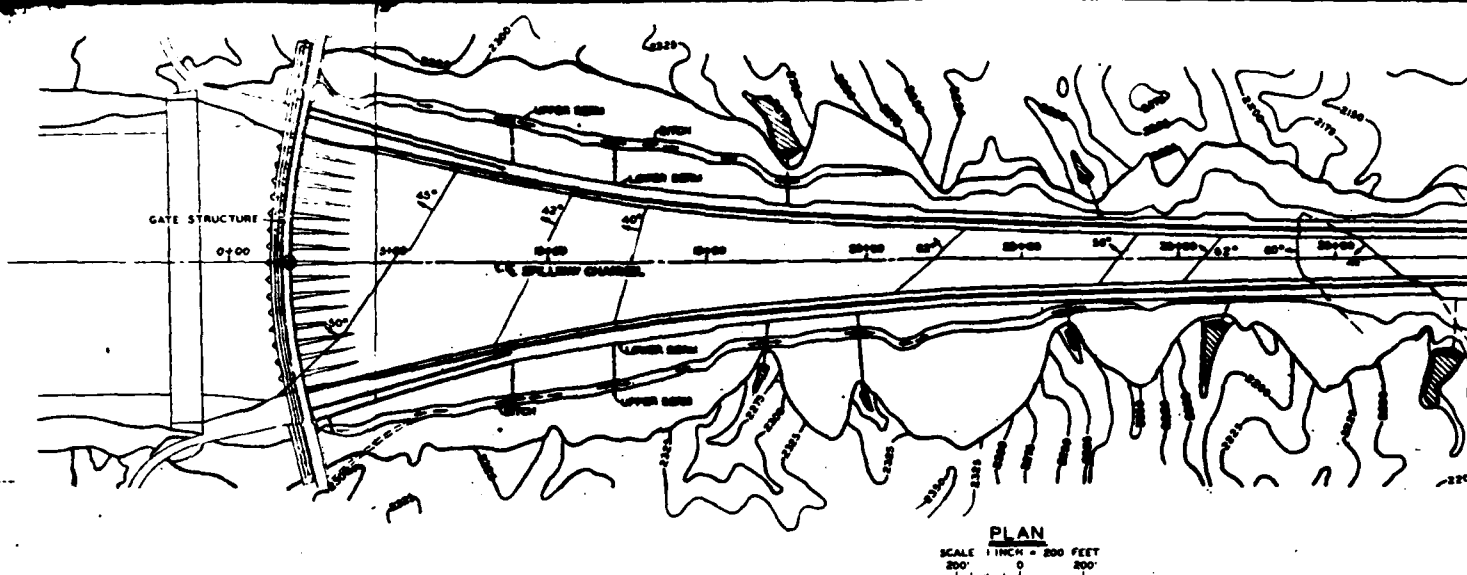
PLAN HAS BEEN REDUCED TO
1/4" = 50' SCALE.

THIS PLAN ACCOMPANIES CONTRACT NO. DA-28-000-04
MULTIPLICATION NO.

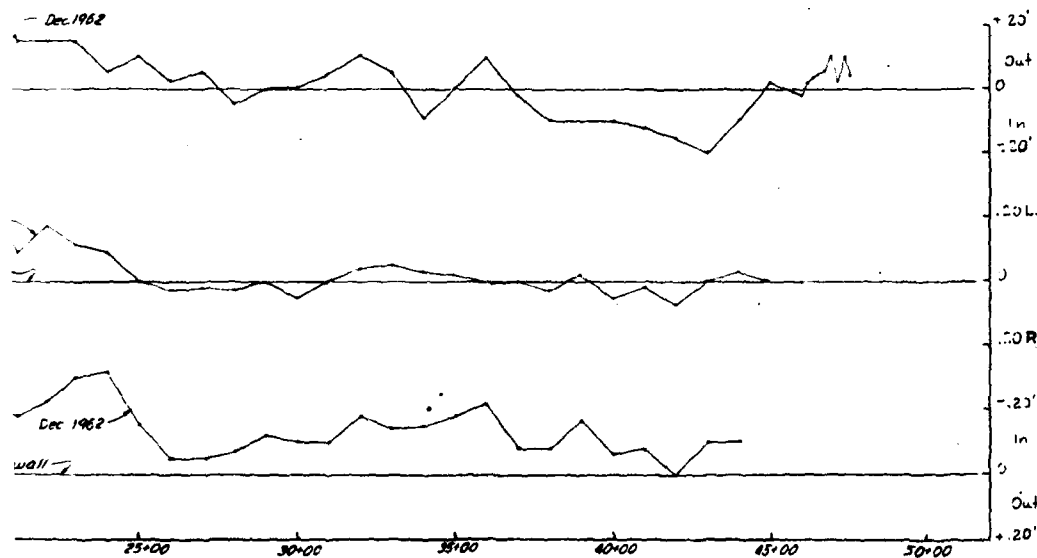
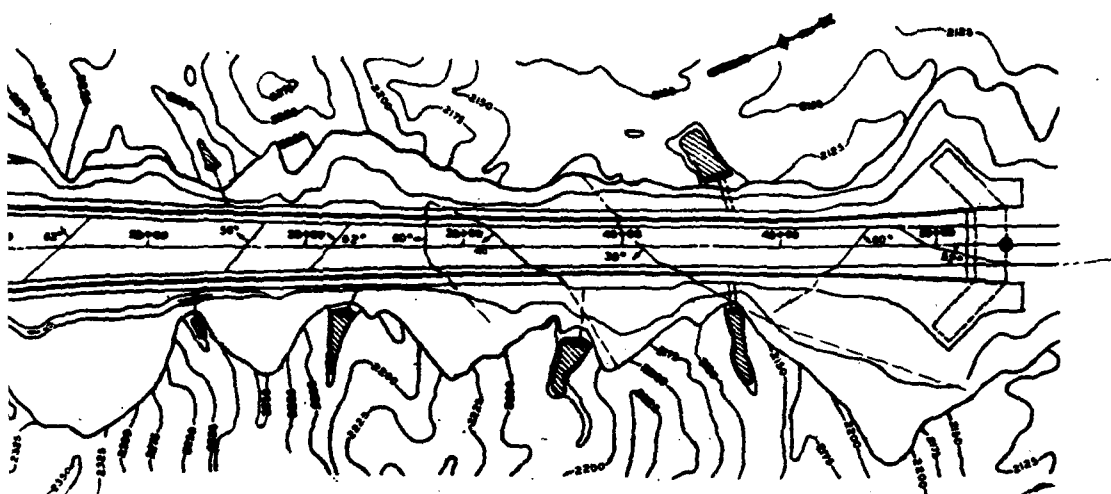


U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA	
MISSOURI RIVER FORT PECK DAM AND RESERVOIR SPILLWAY REHABILITATION HORIZONTAL MOVEMENT SURVEY-PLAN, DETAIL & TIME MOVEMENT GRAPHS	
DESIGNED BY: C. J. J.	DATE: SEPT 1966
DRAWN BY: R. S. S.	SCALE: AS SHOWN
CHECKED BY: R. S. S.	BY: [Signature]
APPROVED BY: [Signature]	DATE: [Blank]
BY: [Signature]	

REPORT OF ENGINEERS



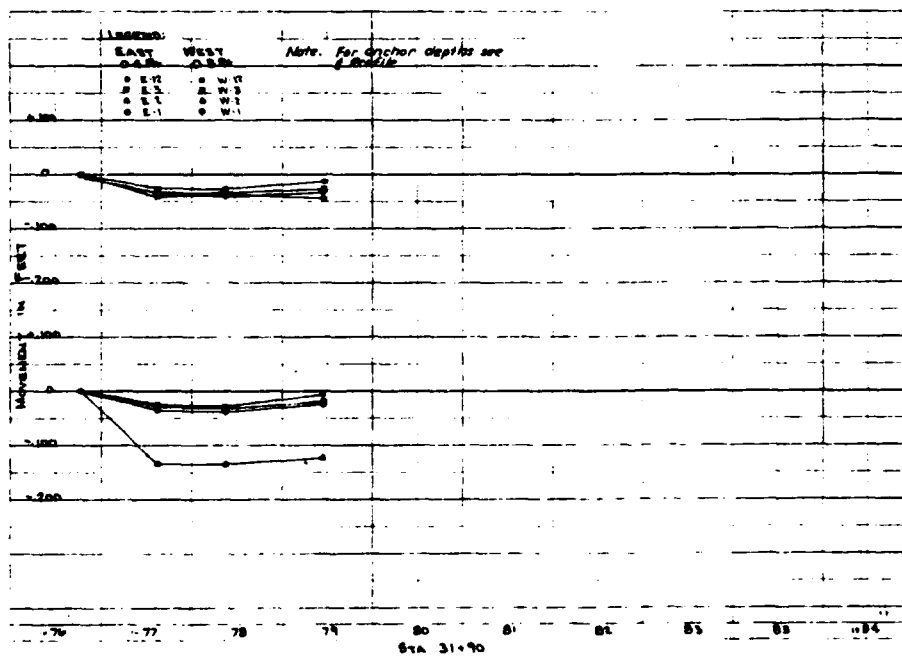
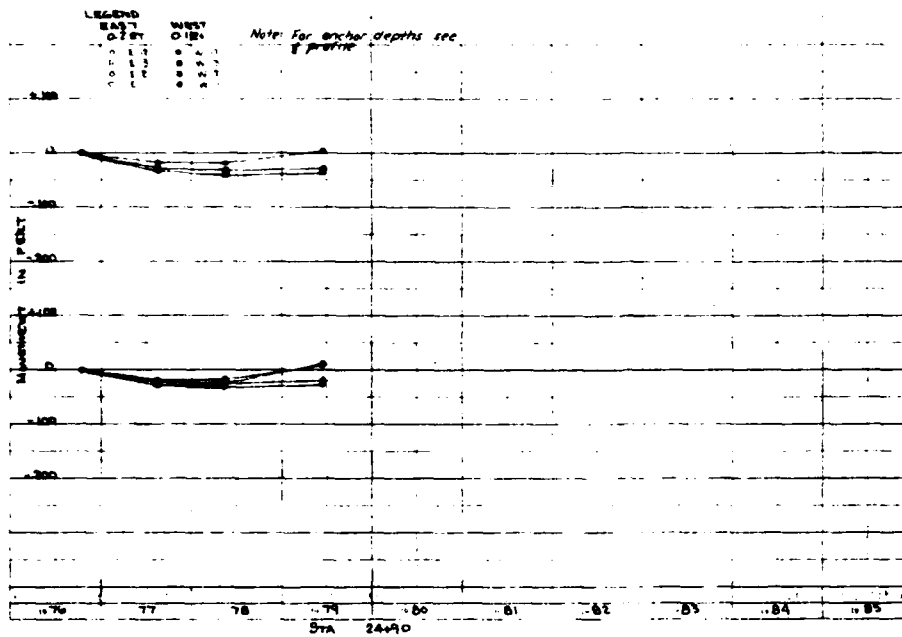
THIS DRAWING HAS BEEN REDUCED TO
THIRTY-FOURTHS THE ORIGINAL SCALE.

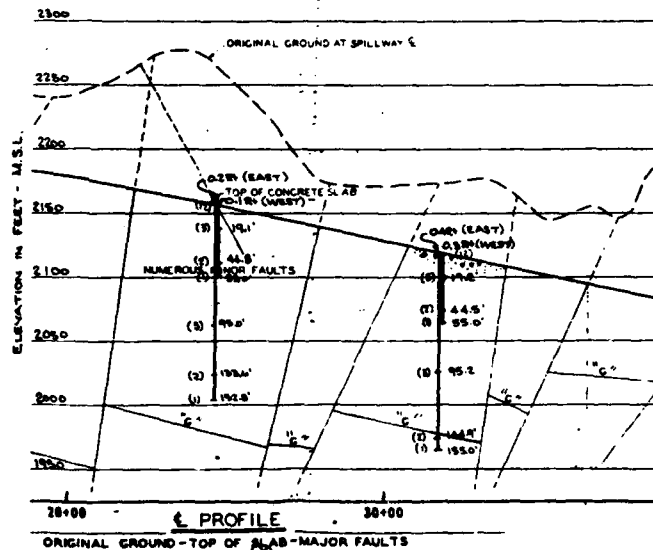
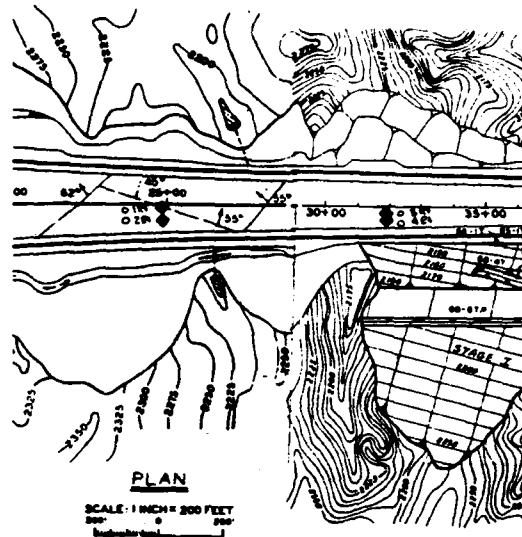


CHANNEL ALIGNMENT



U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA	
MISSOURI RIVER FORT PECK DAM AND RESERVOIR SPILLWAY REHABILITATION ALIGNMENT OF CHANNEL & WALLS	
DESIGNED BY: C. J. J. CHECKED BY: C. J. J. DRAWN BY: C. J. J. APPROVED BY: <i>[Signature]</i> DATE: <i>[Date]</i>	APPROVED BY: <i>[Signature]</i> DATE: <i>[Date]</i>





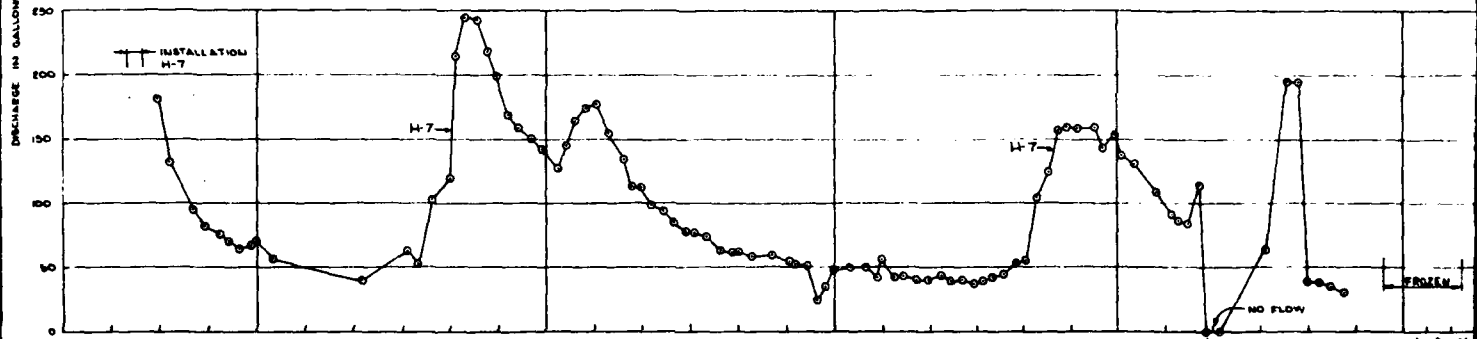
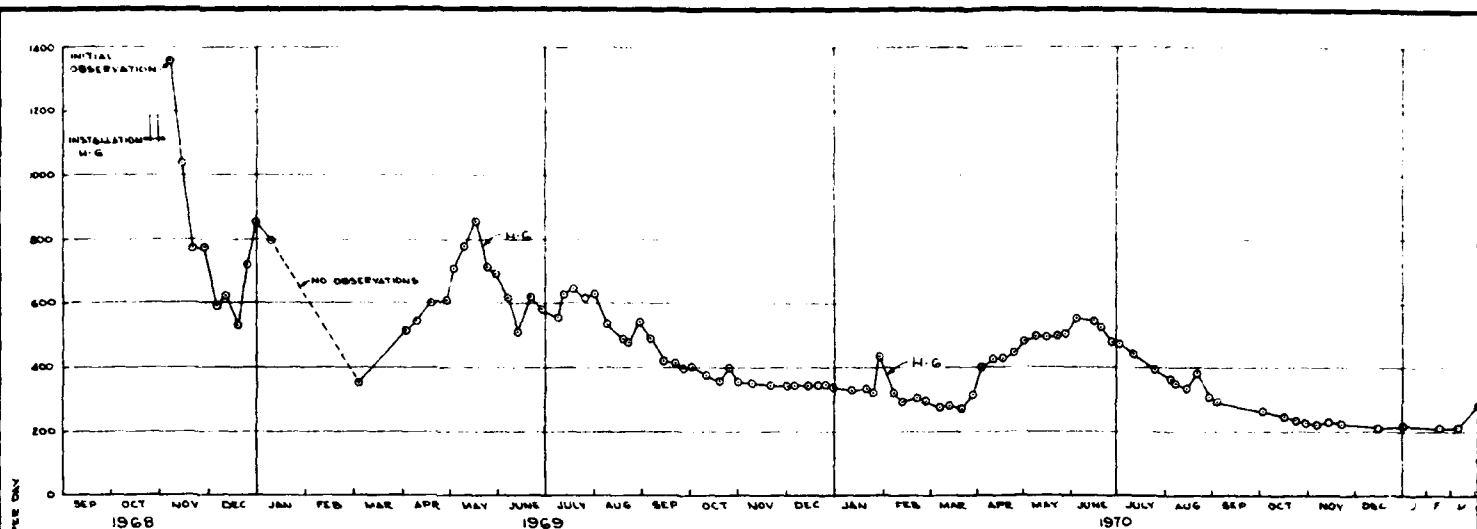
Note: Plotted data obtained from yearly precision survey.
Intermittent readings, not plotted, obtained by gaging
deflections relative to the deepest anchor, assumed to
be fixed.

THIS DRAWING HAS BEEN REDUCED TO
THREE-FIFTHS THE ORIGINAL SCALE.

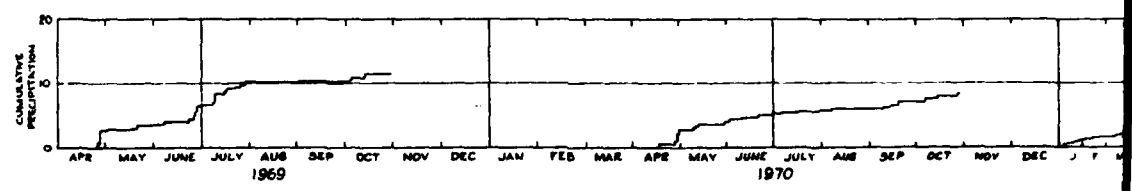
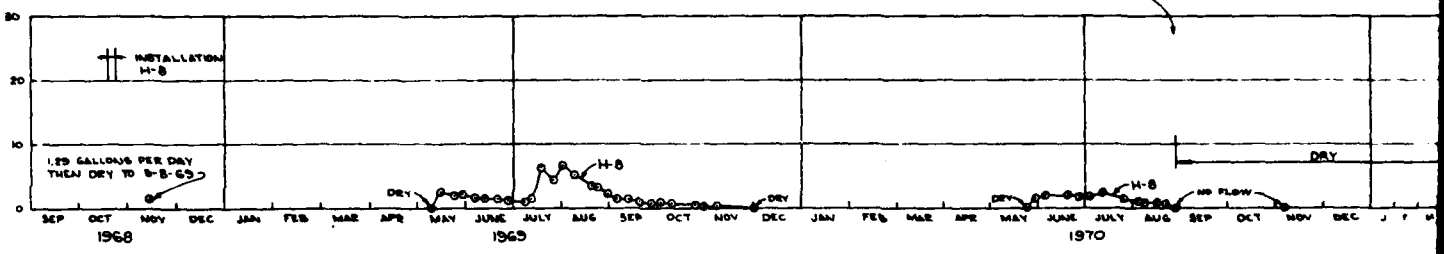


THIS PLAN ASSUMES CERTAIN NO.
MODIFICATION NO.

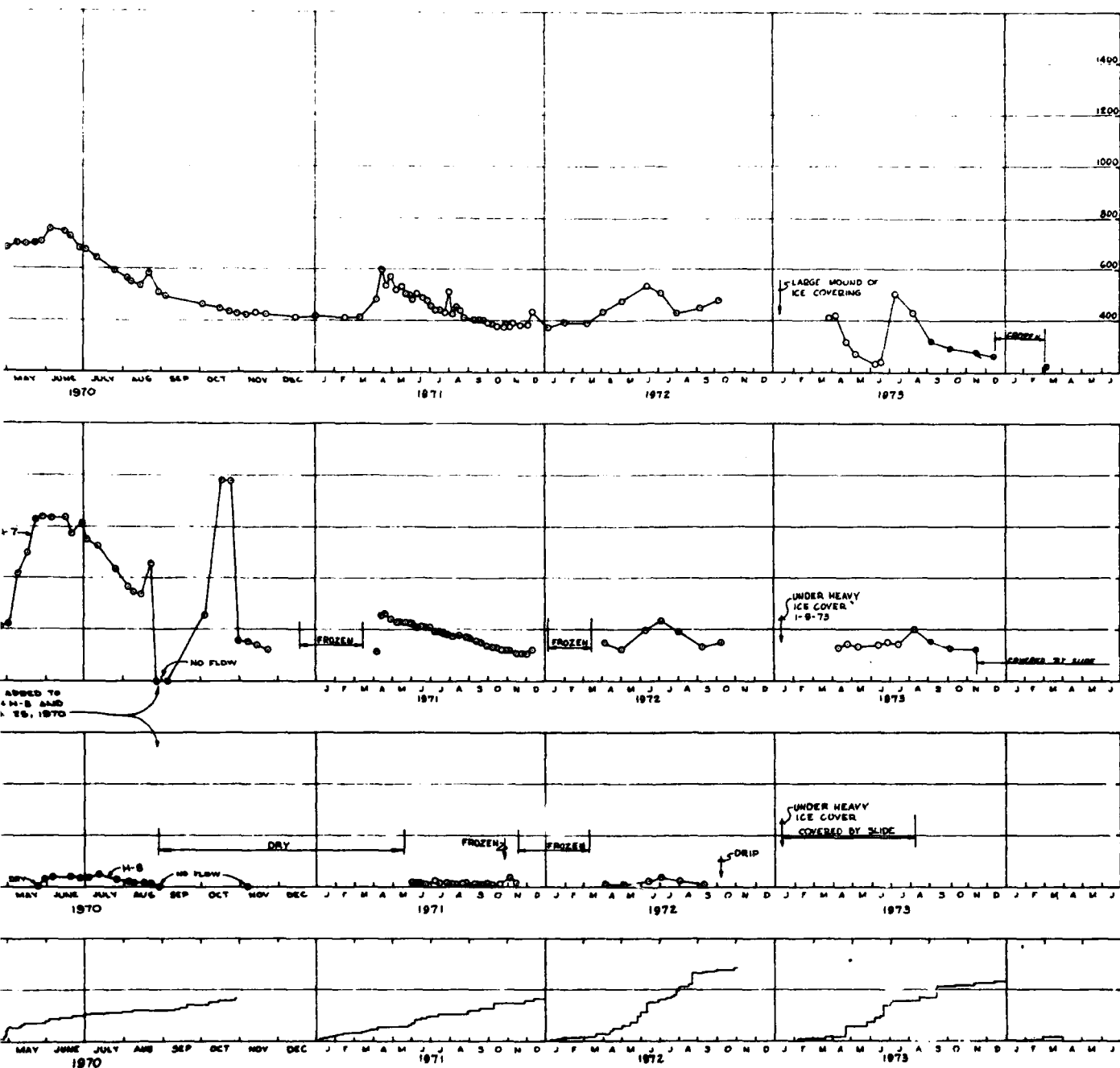
DATE	DESCRIPTION	SCALE	APPROVED
DIVISION			
U. S. ARMY ENGINEER DISTRICT, OMAHA			
CORPS OF ENGINEERS			
OMAHA, NEBRASKA			
DESIGNED BY	MISSOURI RIVER		
DRAWN BY	FORT PECK DAM		
CHECKED BY	SPILLWAY		
APPROVED BY	MULTIPLE REBOUND GAGES		
DATE	SCALE	DATE	SCALE
DATE	SCALE	DATE	SCALE
DATE	SCALE	DATE	SCALE



NOTE: PLASTIC OUTLETS ADDED TO HORIZONTAL DRAINS H-7 & H-8 AND COVERED WITH PILL AUG 15, 1970



SKETCH PLAN
NO SCALE
THIS IS A SKETCH PLAN
COMPLETED BY SHOWN ON SKETCH PLAN



THIS DRAWING HAS BEEN REDUCED TO
THREE-EIGHTHS THE ORIGINAL SCALE.



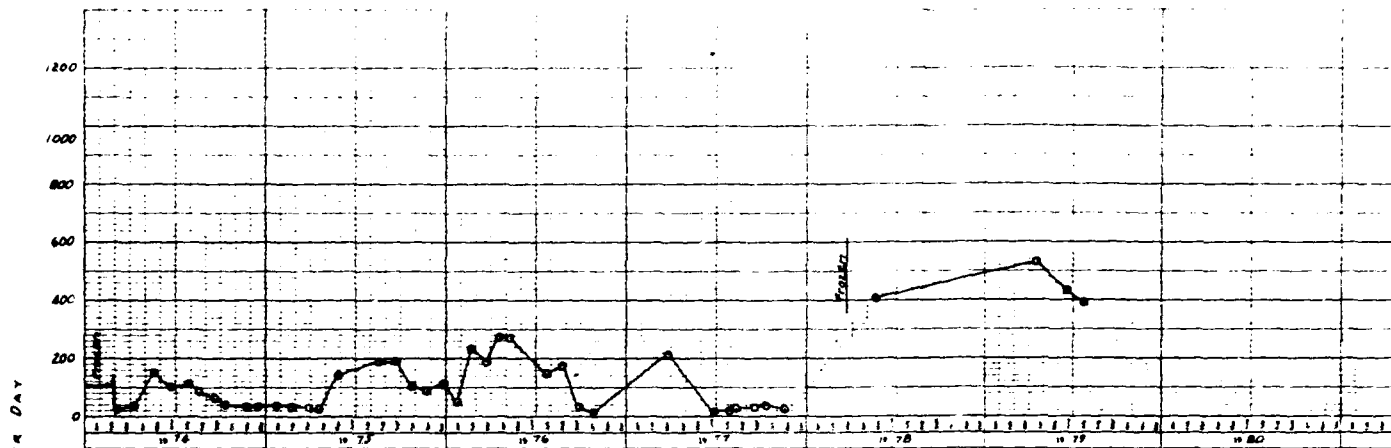
THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.

REVISIONS		DATE	BY	APPROVED
U. S. ARMY ENGINEER DISTRICT, OMAHA GROUP OF ENGINEERS OMAHA, NEBRASKA				
PROJECT NO. 1-7-73		MISSOURI RIVER		
DRAWN BY: L.L.L.		FORT PECK LAKE, MONTANA		
CHECKED BY: R.T.		SPILLWAY SLOPE EXCAVATION		
APPROVED BY: [Signature]		HORIZONTAL DRAINS		
DATE: [Signature]		TIME DISCHARGE RECORD		
SHEET 2		SEP. 1973		
[Signature]		[Signature]		
[Signature]		[Signature]		

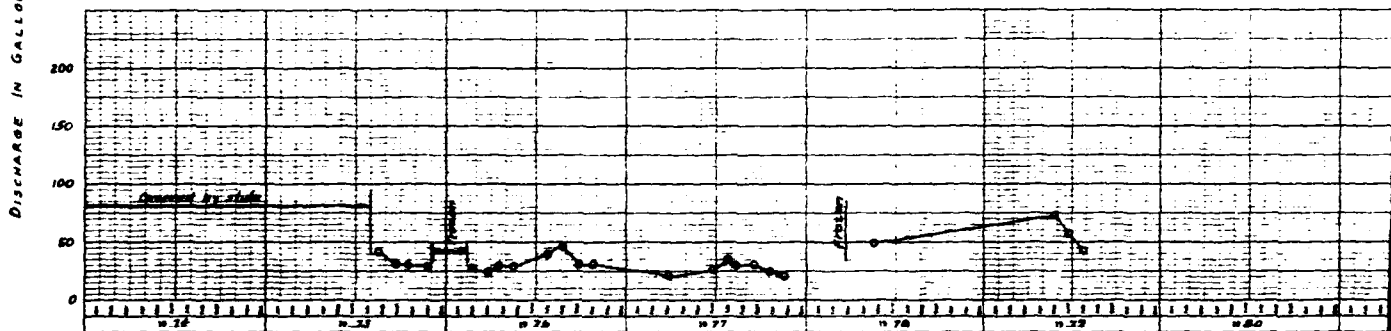
CONSTRUCTION FOUNDATION REPORT

PLATE 105

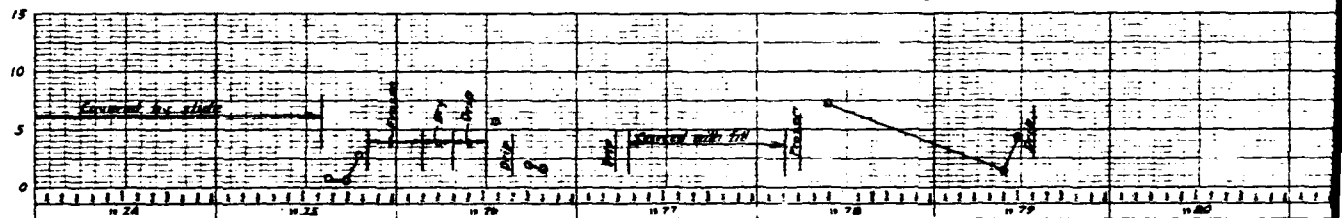
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H-6

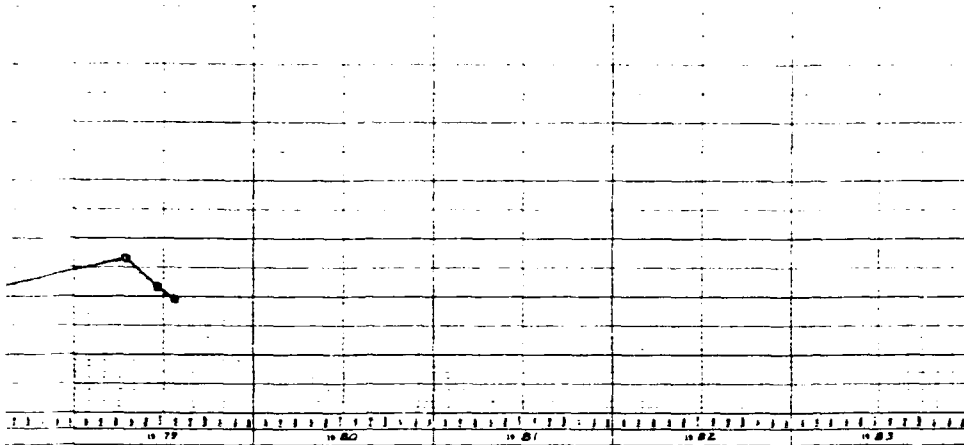


H-7

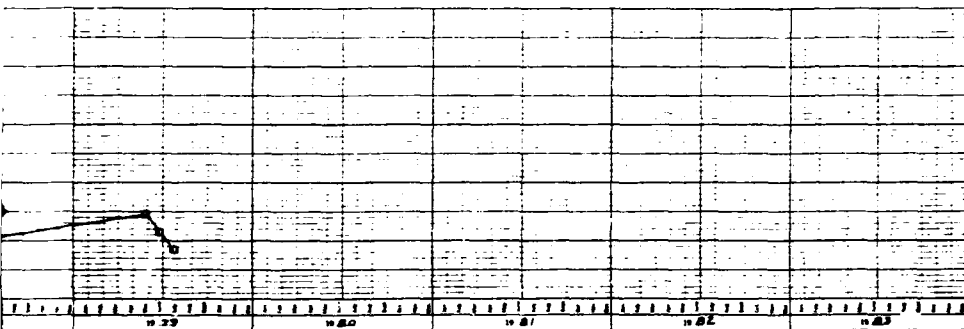


H-8

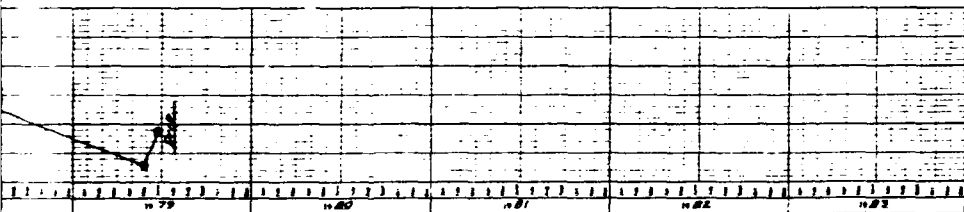




H-6



H-7



H-8

THIS DRAWING HAS BEEN REDUCED TO
THREE-FIFTHS THE ORIGINAL SCALE.

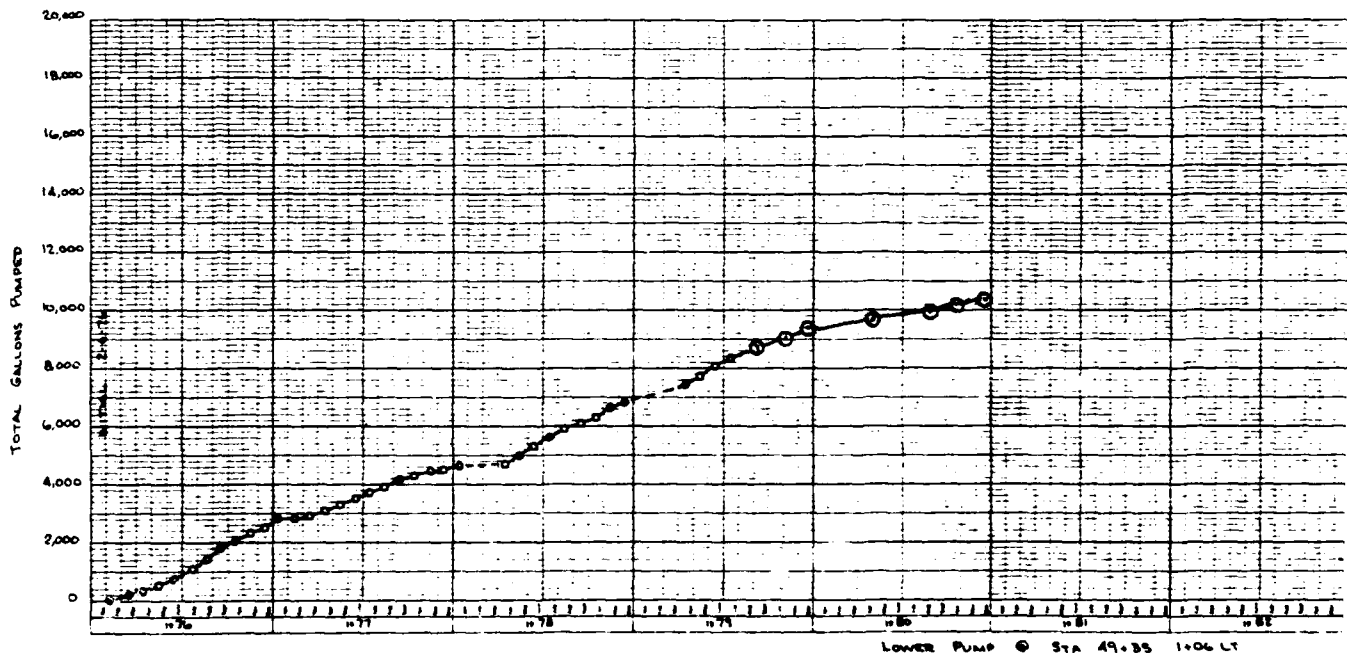
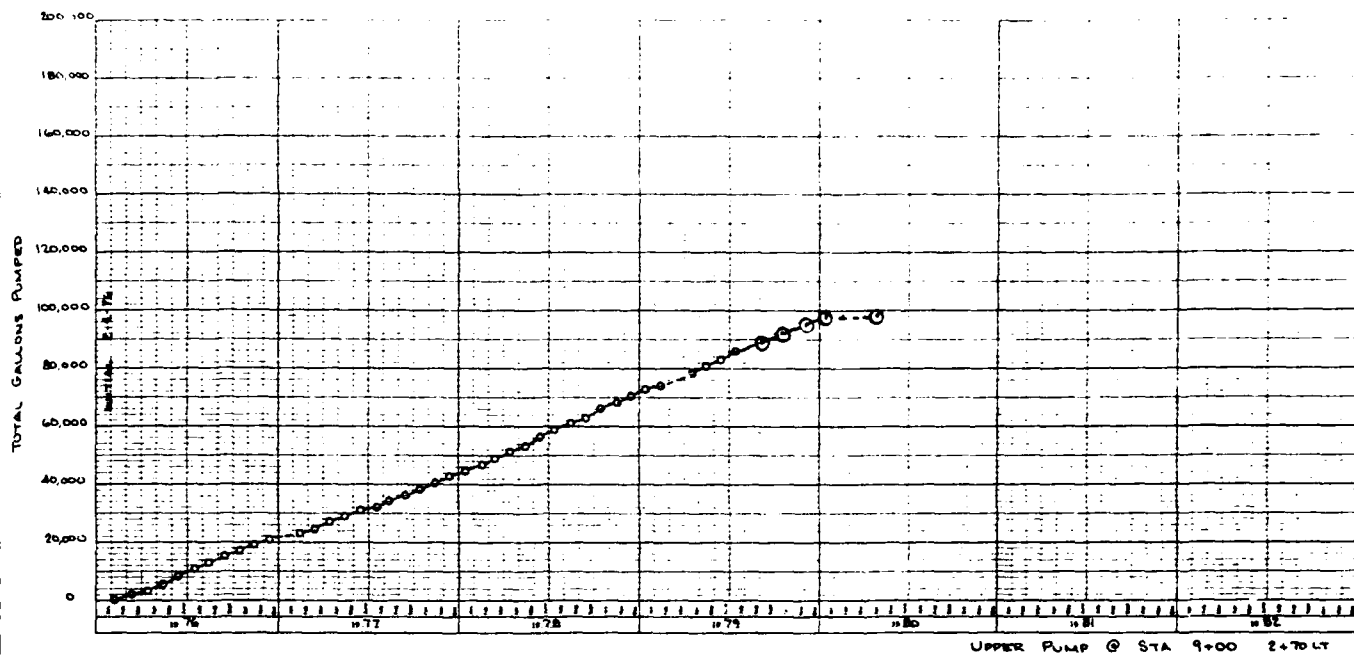


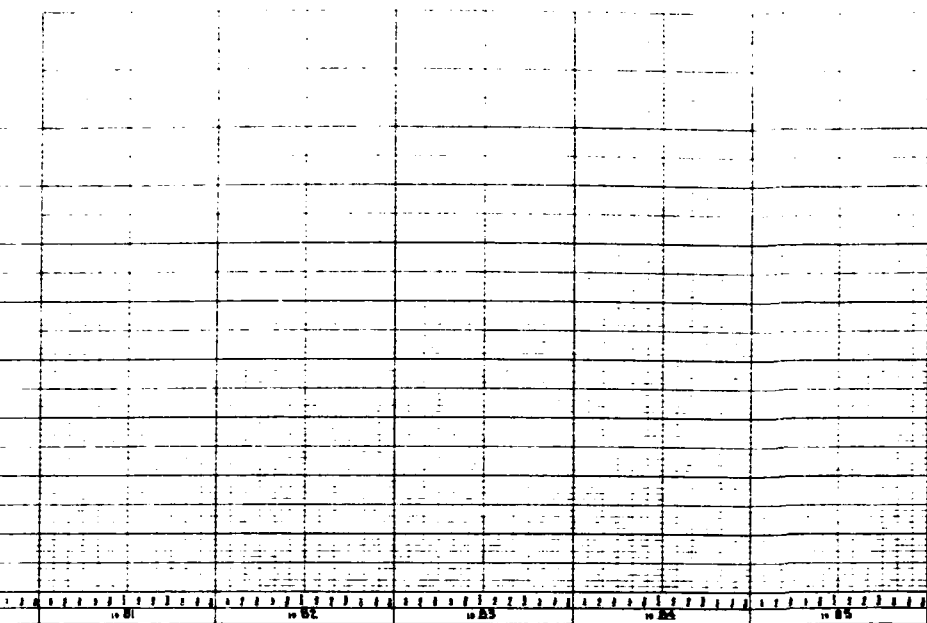
THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.

DATE		REVISIONS		REVISION	DATE
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA					
DESIGNED BY:		MISSOURI RIVER			
CHECKED BY:		FORT PECK LAKE MONTANA			
DRAWN BY:		SPILLWAY SLOPE EXCAVATION			
REVIEWED BY:		HORIZONTAL DRAINS			
DATE:		TIME DISCHARGE RECORD			
SCALE:		SHEET 2A			
APPROVED:		DATE:		DATE:	
BY:		FOR:		DATE:	
BY:		FOR:		DATE:	

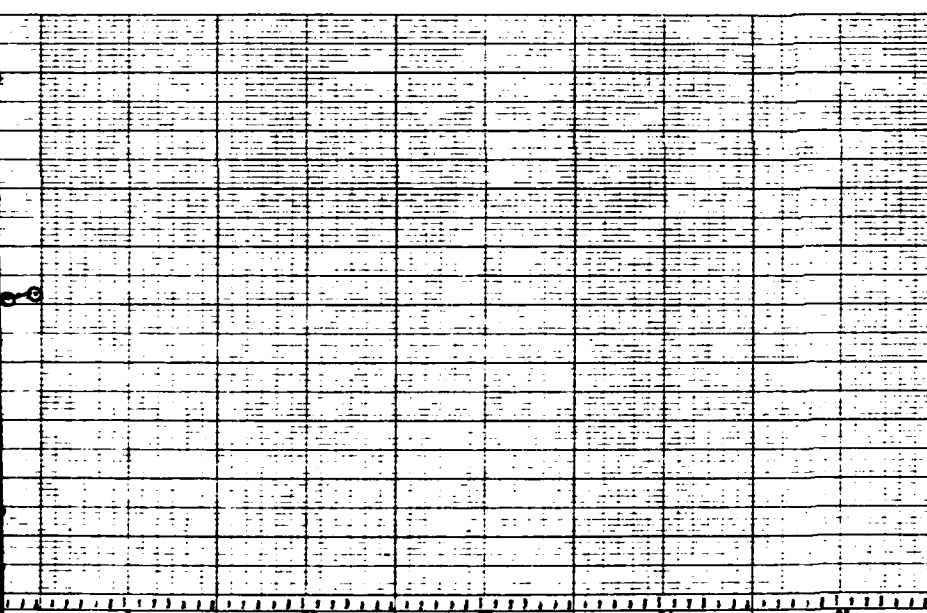
CONSTRUCTION FOUNDATION REPORT

2 PLATE 106





UPPER PUMP @ STA 9+00 2+70 LT



PUMP @ STA 49+35 1+06 LT

THIS DRAWING HAS BEEN RE-
THREE-FOURTHS THE ORIGINAL

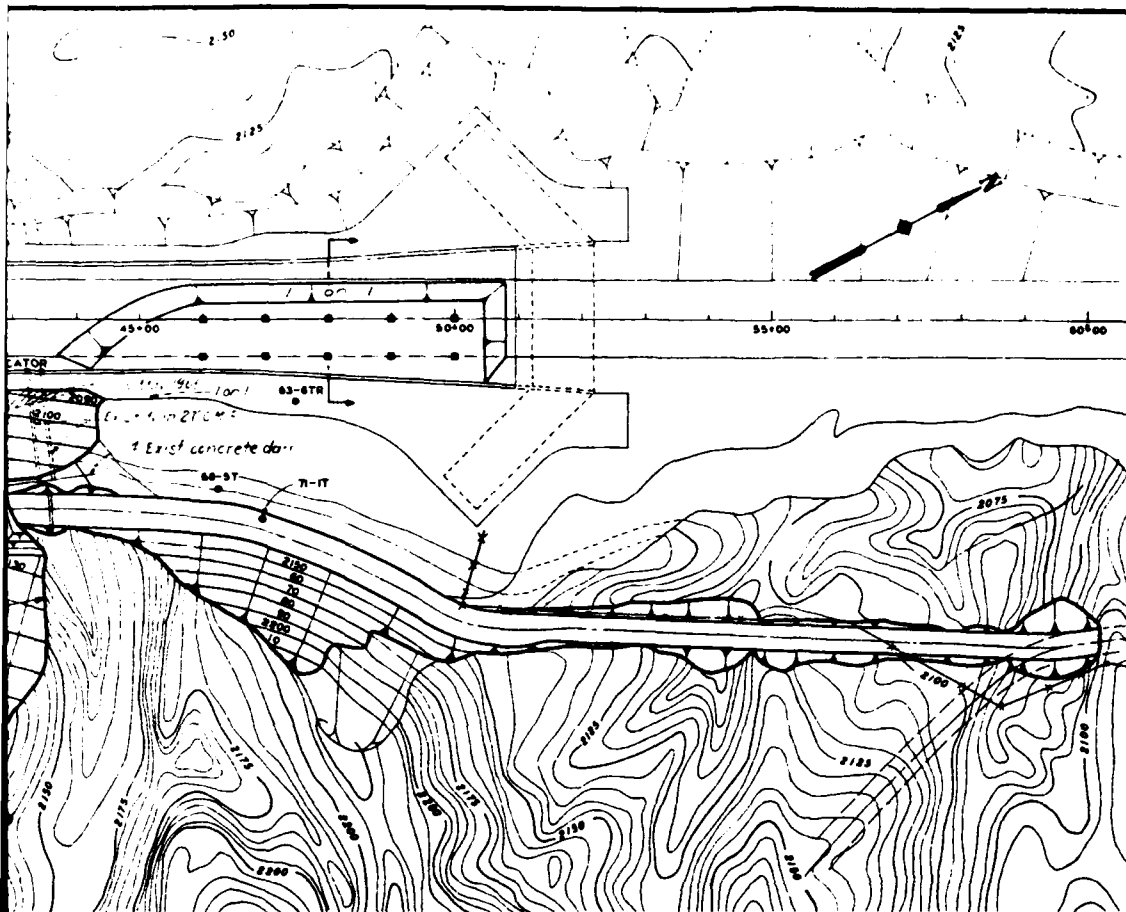


THIS PLAN ACCOMPANIES CONTRACT NO.
REGISTRATION NO.

DATE		DESCRIPTION		SCALE	APPROVED
DIVISION					
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA					
DESIGNED BY:	MISSOURI RIVER FORT PECK DAM SPILLWAY				
DRAWN BY:	SHALE PUMPED DRAINAGE WELLS SW 9/2 74 L & SW 49 3/104 L				
CHECKED BY:	DATE	APPROVED	DATE	APPROVED	DATE
OFFICE		FIELD		DATE	
APPROVED		APPROVED		DATE	

CONSTRUCTION FOUNDATION REPORT

PLATE 107

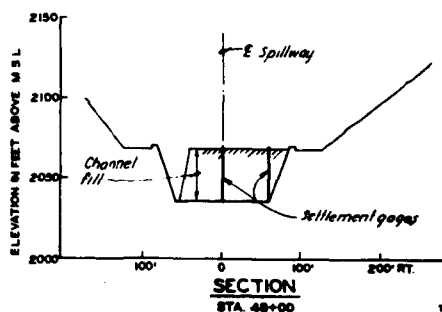
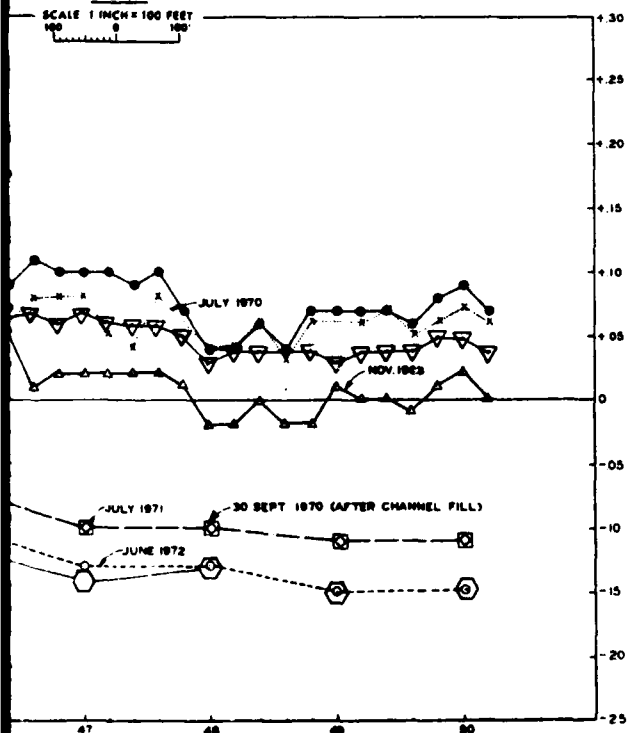


LEGEND:

- TILT METER
- ▲ REBOUND GAGES
- SETTLEMENT GAGES
- DIAL INDICATOR INSTALLATION

PLAN

SCALE 1 INCH = 100 FEET



THIS DRAWING HAS BEEN REDUCED TO THREE-FOURTHS THE ORIGINAL SCALE.

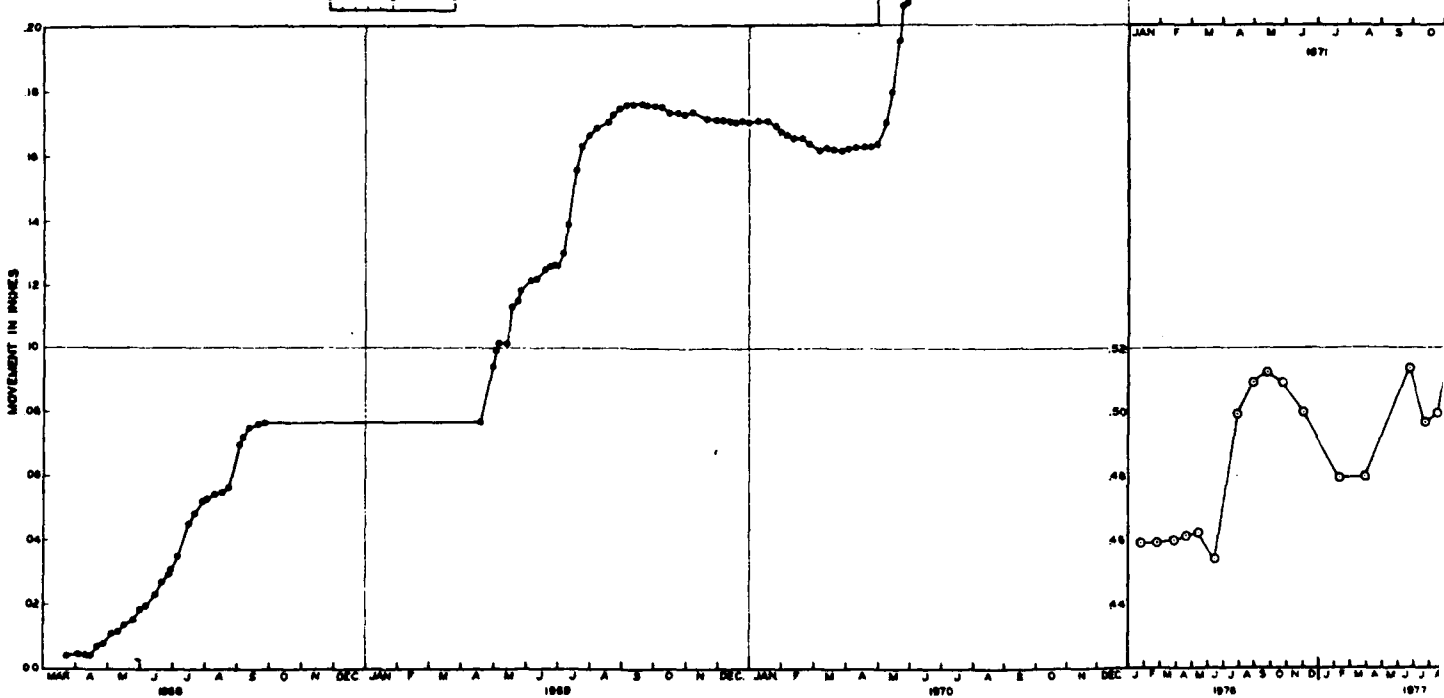
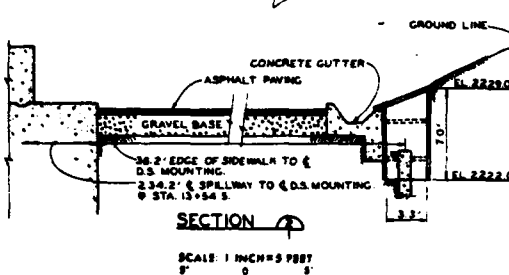
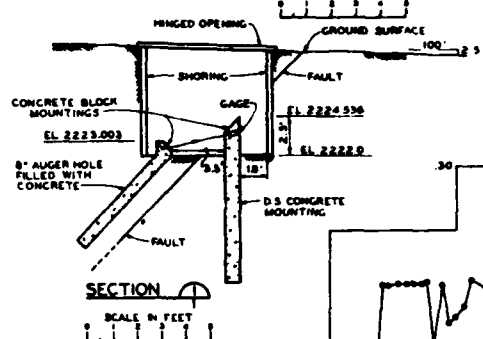
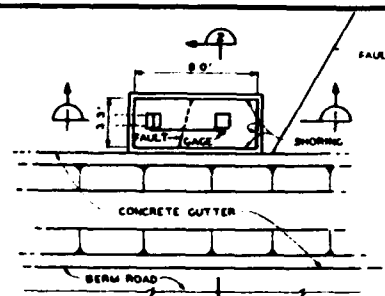
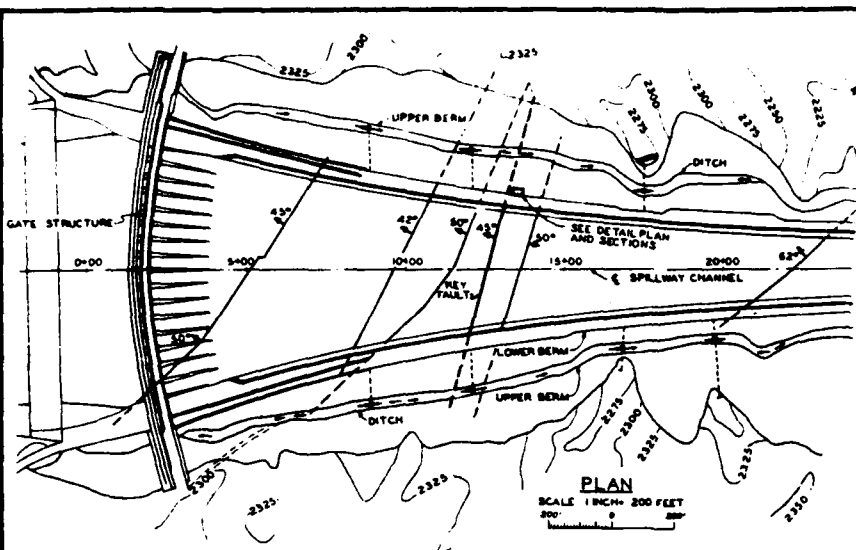


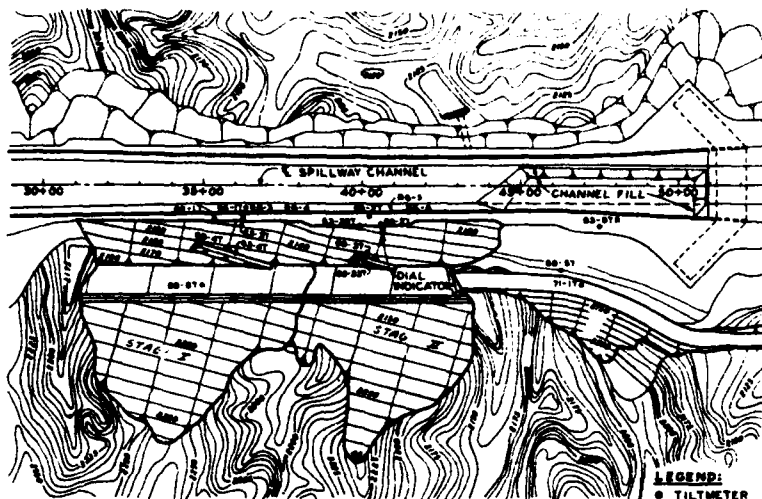
THIS PLAN ACCOMPANIES CONTRACT NO. MODIFICATION NO.

DATE		REVISION		DATE	APPROVED
REVISION					
U. S. ARMY ENGINEER DISTRICT, OMAHA BUREAU OF ENGINEERING OMAHA, NEBRASKA					
DESIGNED BY: G. W. A.		MISSOURI RIVER			
CHECKED BY: A. L. M.		FORT PECK LAKE, MONTANA			
DRAWN BY: C. V. J.		SPILLWAY SLOPE EXCAVATION			
REVIEWED BY: <i>Ed. M. M.</i>		CHANNEL FILL			
SUPERVISOR: <i>E. L. M.</i>		SETTLEMENT GAGES			
OFFICE: <i>Ed. M. M.</i>		DATE: <i>SEP 67</i>		SHEET: <i>SEP 67</i>	
APPROVED: <i>Ed. M. M.</i>		DATE: <i>SEP 67</i>		SHEET: <i>SEP 67</i>	

CONSTRUCTION FOUNDATION REPORT

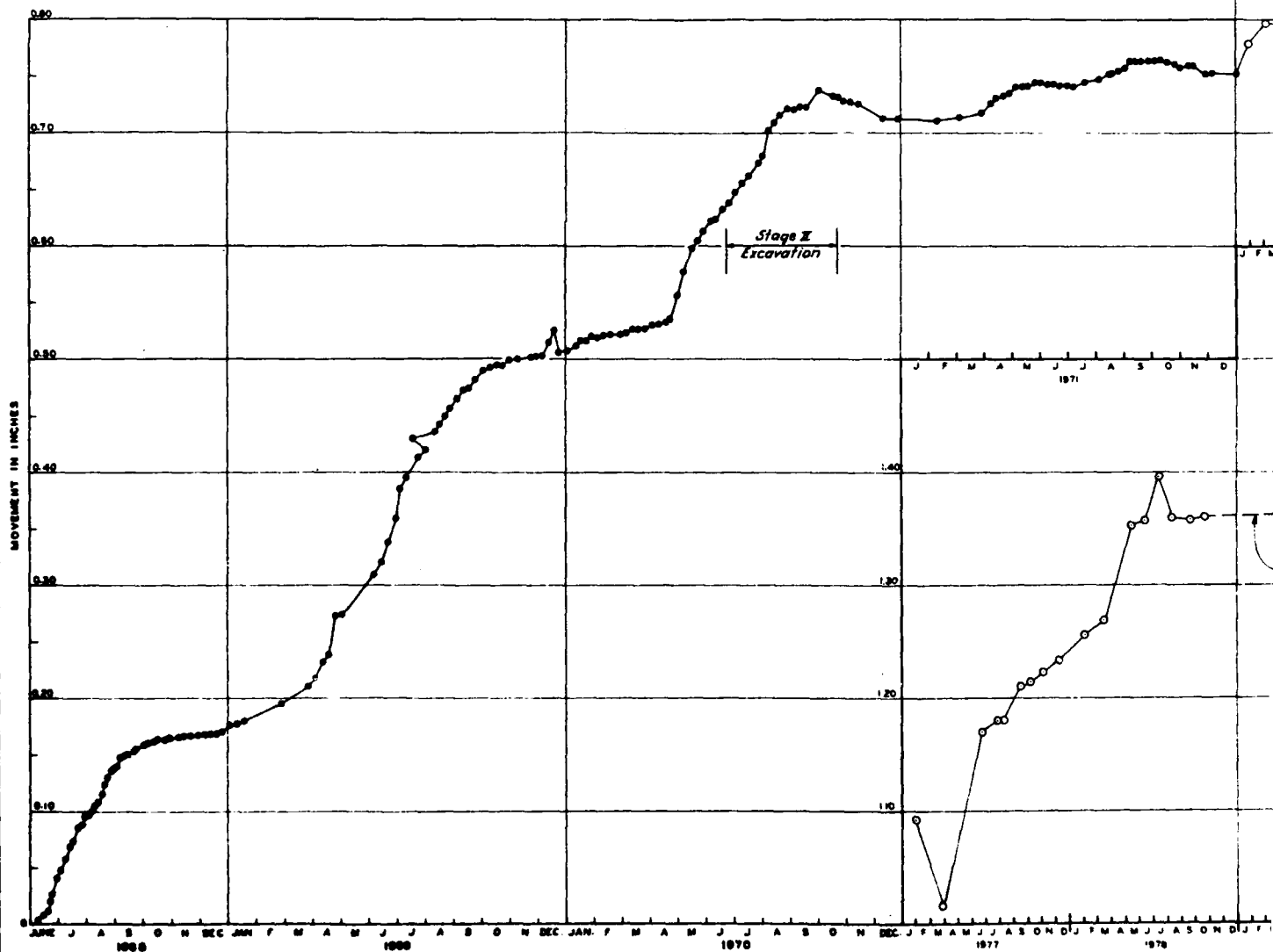
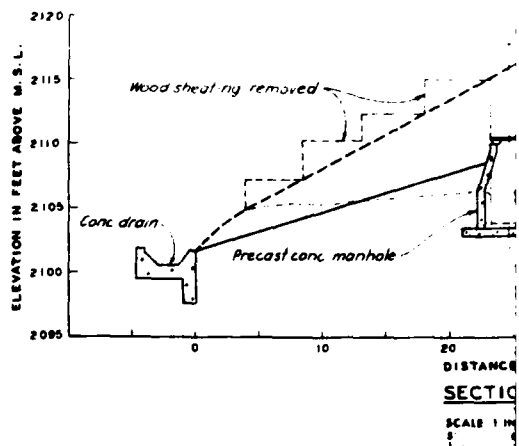
PLATE 108

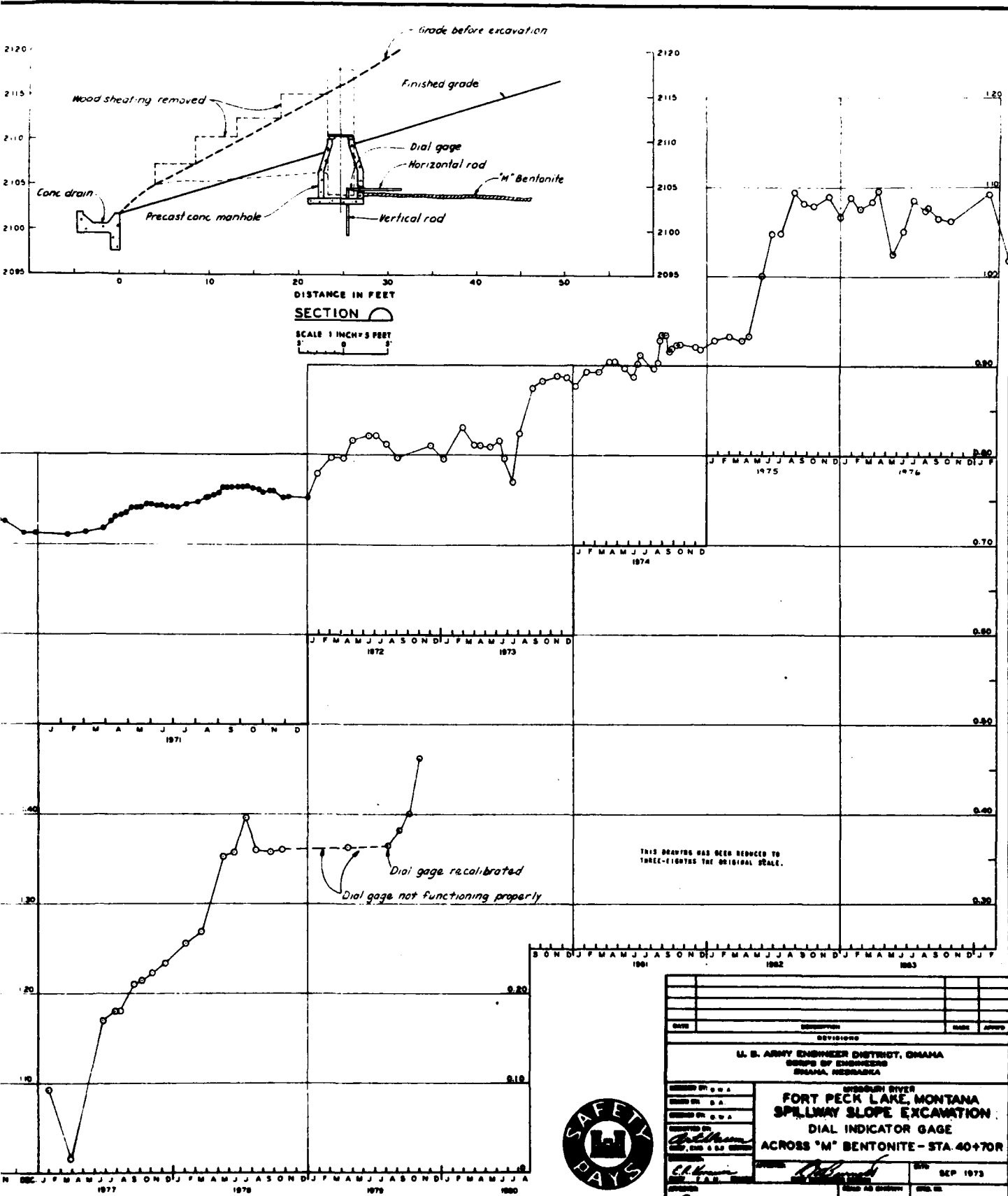




KEY PLAN

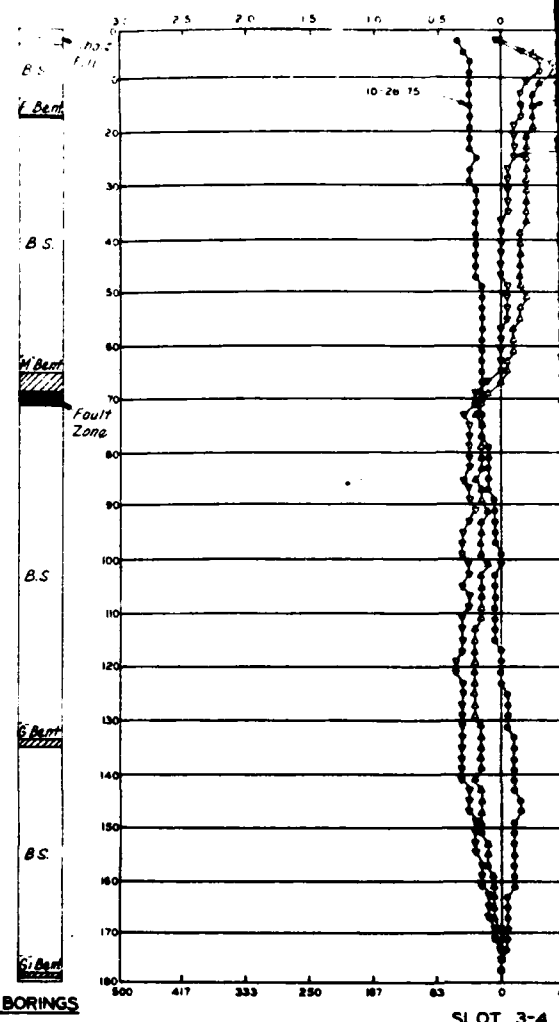
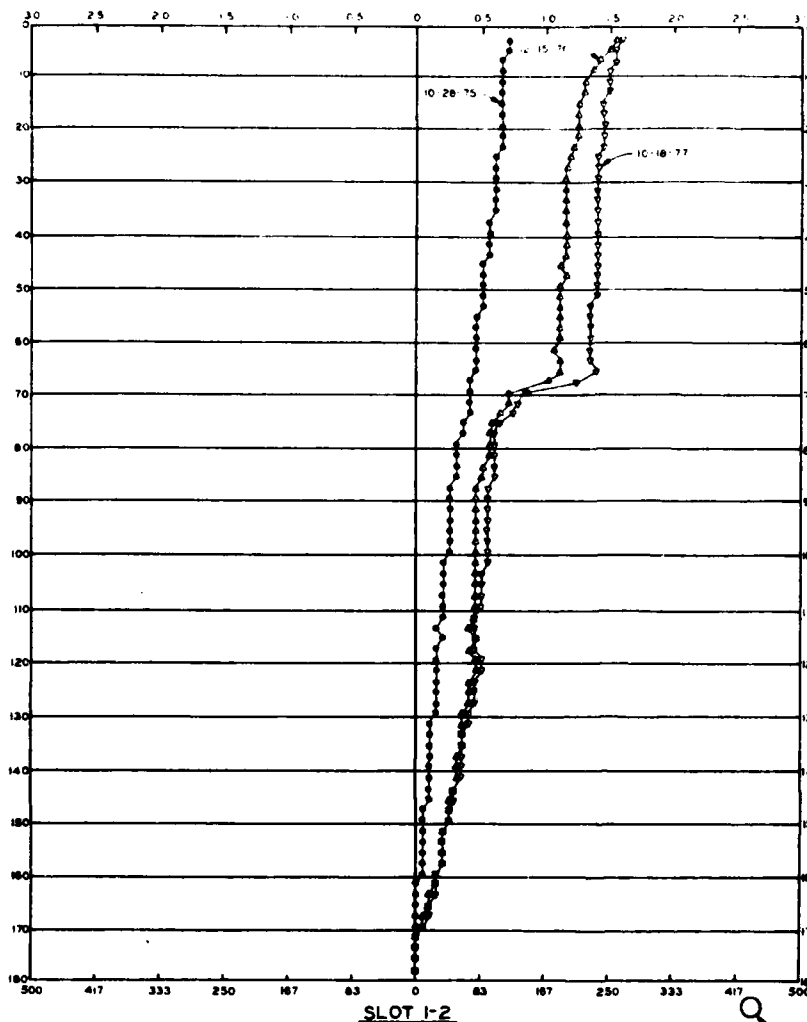
LEGEND:
 ○ TILTMETER
 ▲ REBOUND GAGE



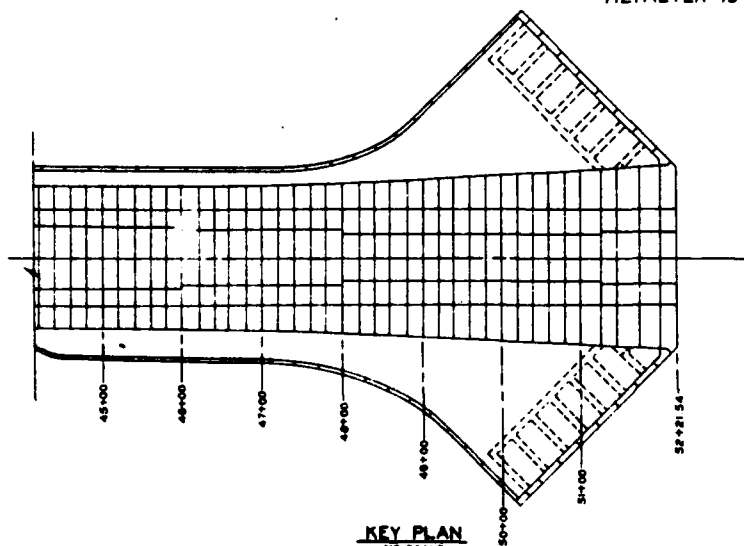


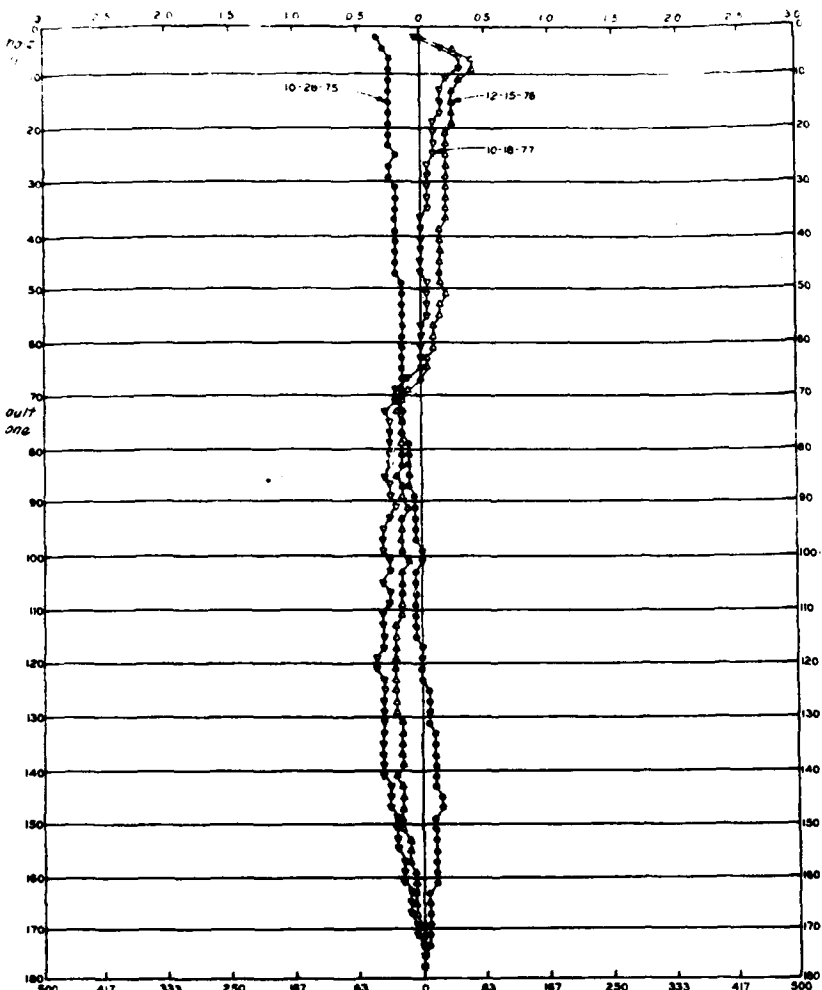
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA	
FORT PECK LAKE, MONTANA SPILLWAY SLOPE EXCAVATION DIAL INDICATOR GAGE ACROSS "M" BENTONITE - STA. 40+70R	
DESIGNED BY: <i>[Signature]</i> CHECKED BY: <i>[Signature]</i> DATE: <i>[Signature]</i>	DATE: <i>[Signature]</i> BY: <i>[Signature]</i> FOR: <i>[Signature]</i>
SEP 1973 OMAHA, NEBRASKA	

2



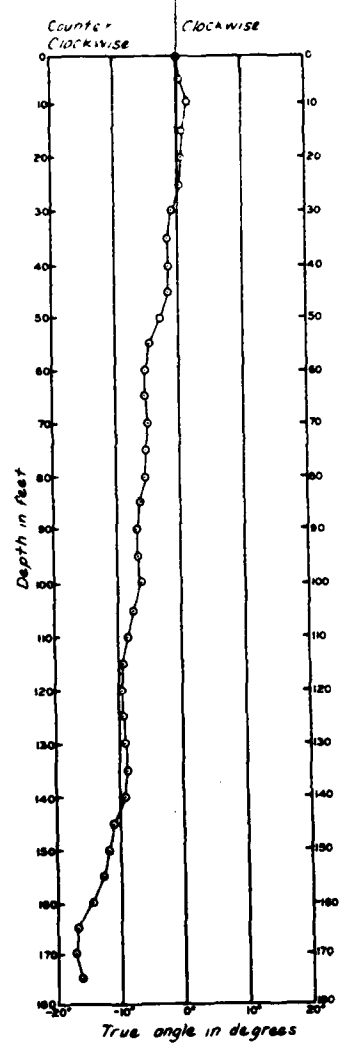
Note: B.S. = Bearpaw FM. Clay Shale
 Note: Fault zone distinguished by a significant slickensided surface and a lower crushed zone. Calculated vertical displacement measured to be 176 ft.





Bearpaw FM Clay Shale
 It zone distinguished by a significant
 ed surface and a lower crushed zone.
 vertical displacement measured
 ft.

SLOT 3-4



GROOVE SPIRAL
 11-18-75

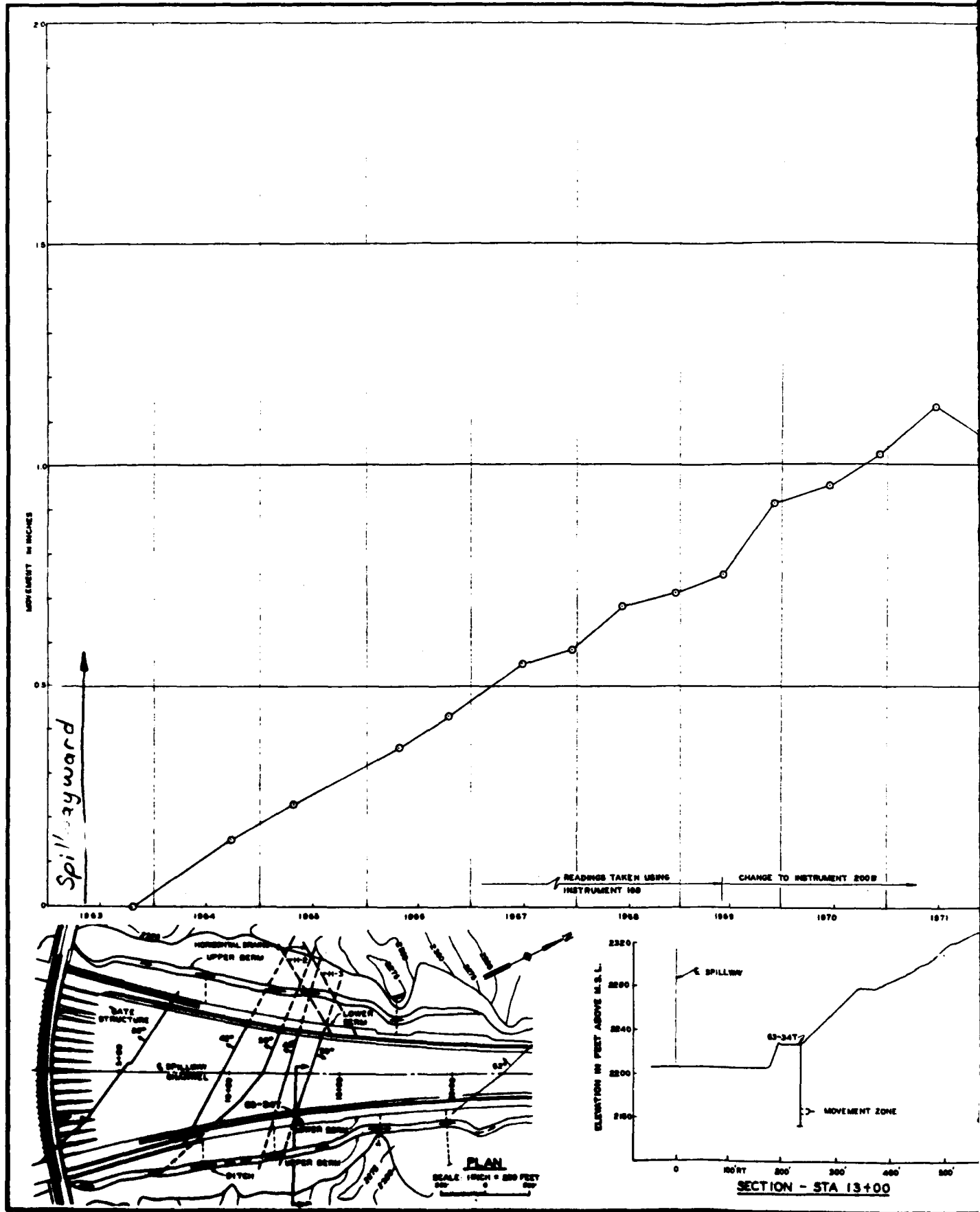


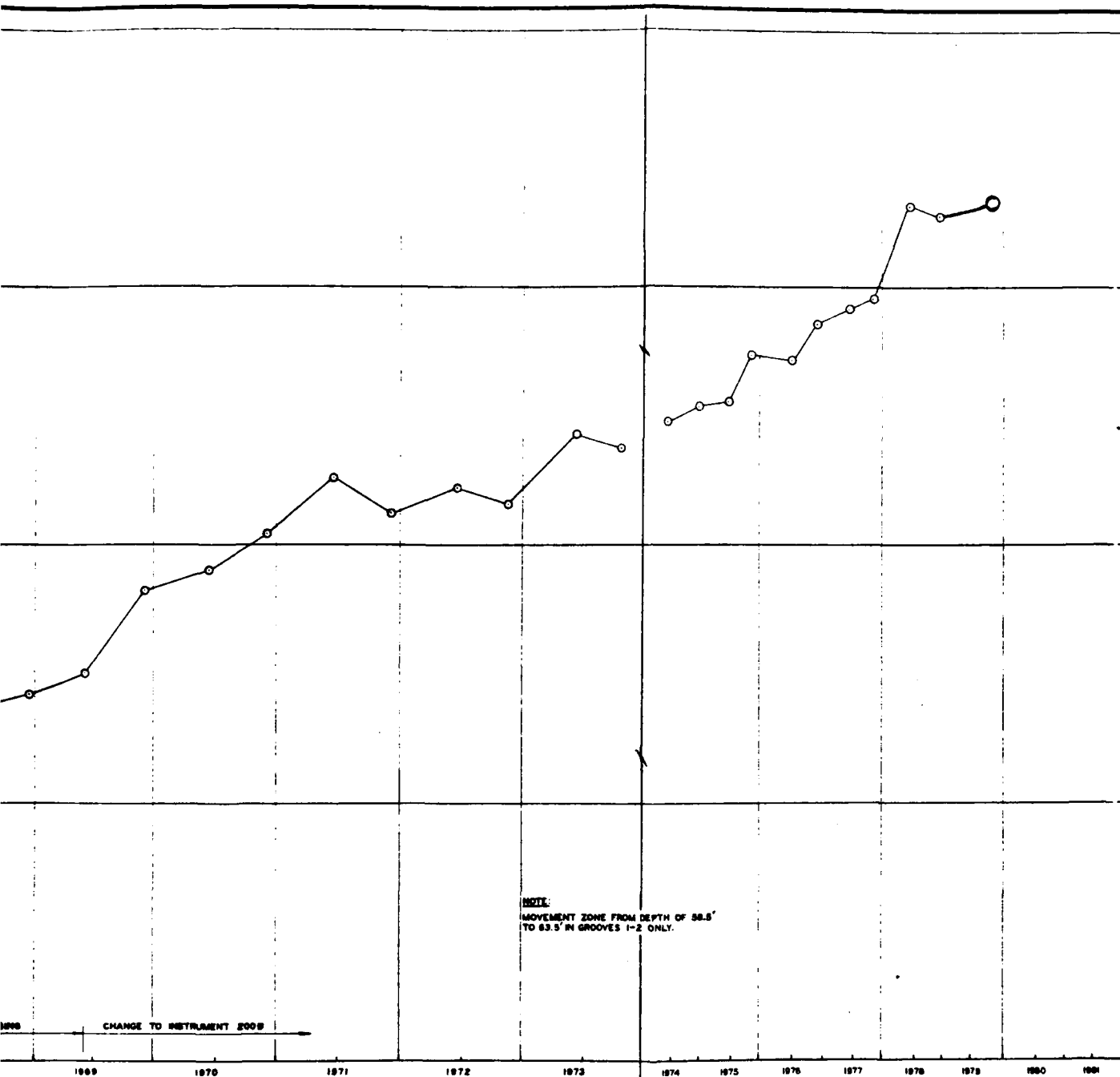
THIS DRAWING HAS BEEN REDUCED TO
 THREE-FOURTHS THE ORIGINAL SCALE.



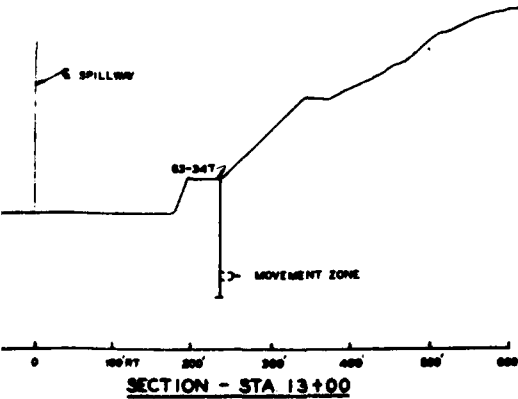
THIS PLAN ACCOMPANIES CONTRACT NO.
 REGISTRATION NO.

U. S. ARMY ENGINEER DISTRICT, OKLAHOMA		DIVISION	
MISSOURI RIVER FORT PECK DAM TILTMETER OBSERVATIONS SLOPE INDICATOR 75-12T INSTRUMENT-2000 ACCUMULATED DEFLECTION			
DESIGNED BY	CHECKED BY	DATE	SCALE
DRAWN BY	APPROVED BY	DATE	SCALE
INCHES	FEET	DATE	SCALE





CHANGE TO INSTRUMENT 2008



THIS DRAWING HAS BEEN REDUCED TO
THREE-EIGHTHS THE ORIGINAL SCALE.

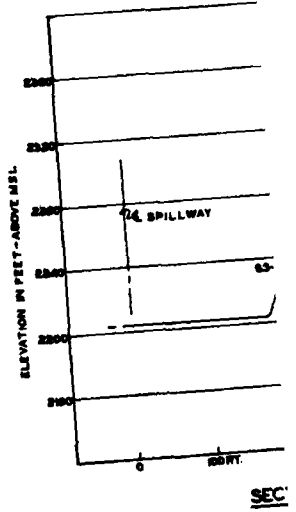
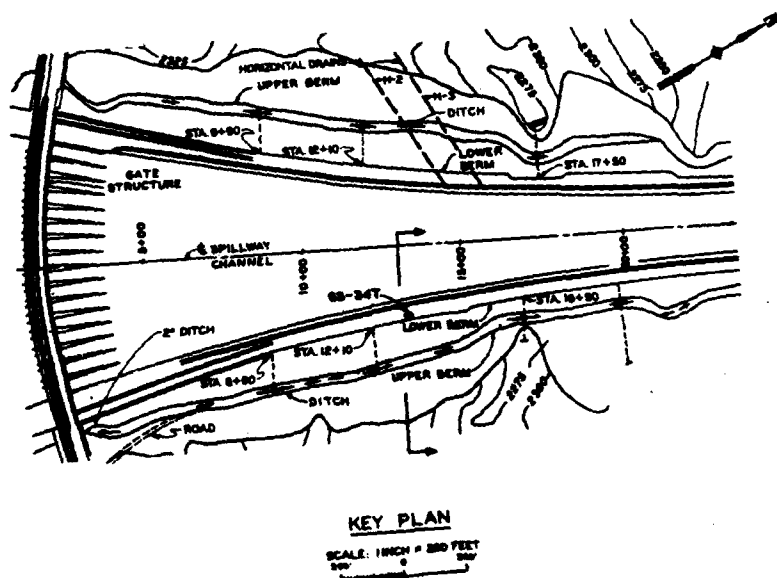
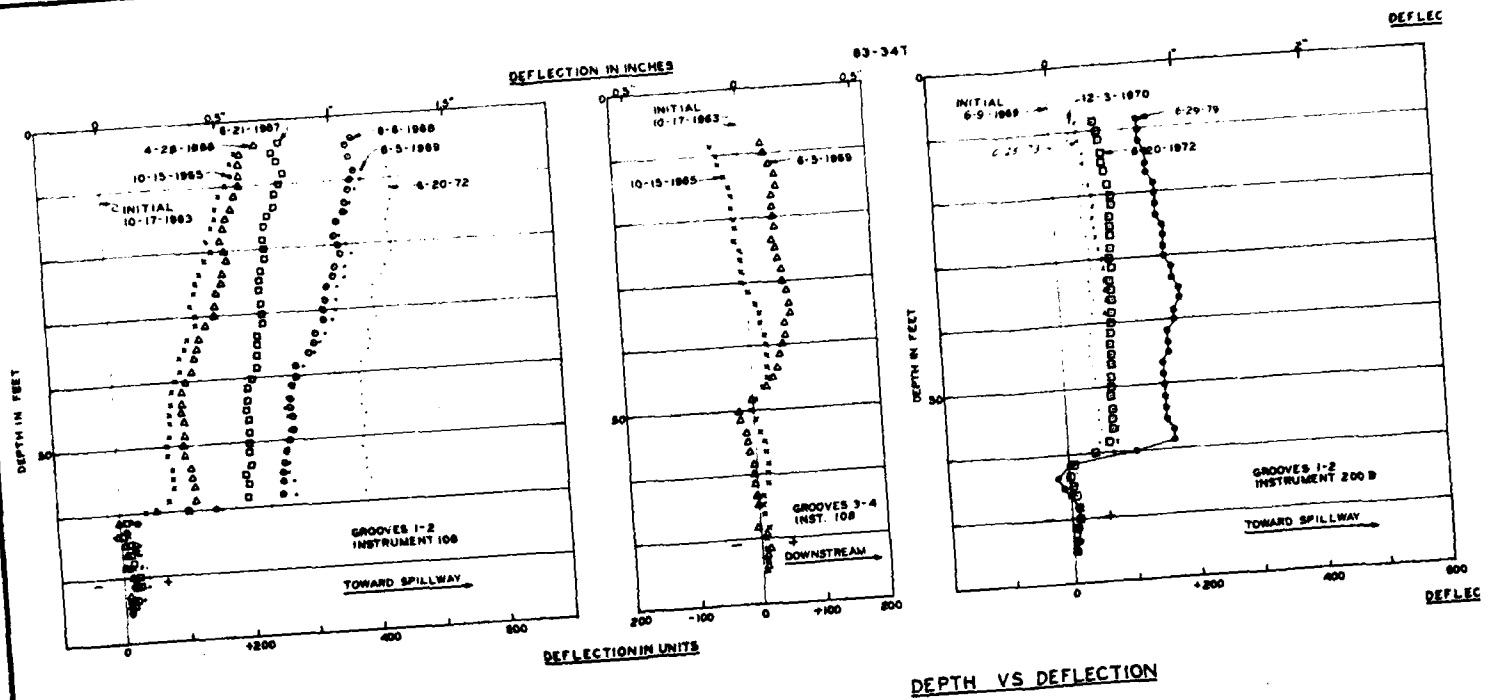


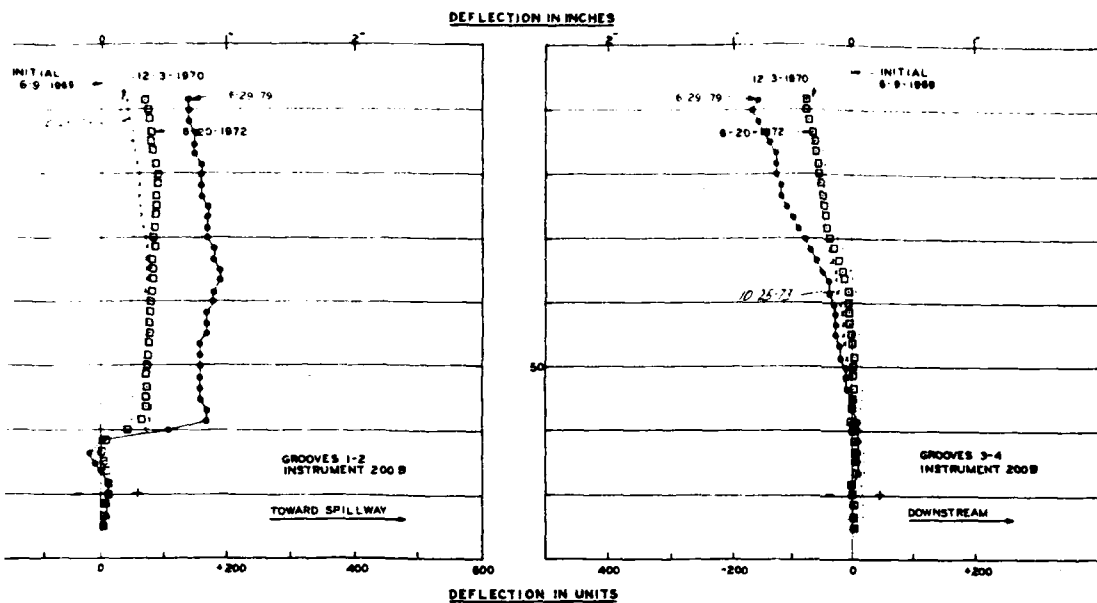
THIS PLAN ACCOMPANIES CERTIFICATE NO.
MODIFICATION NO.

U. S. ARMY ENGINEER DISTRICT, DAKOTA CORPS OF ENGINEERS DAKOTA, NEBRASKA	
DESIGNED BY: CHECKED BY: C.V.J. DRAWN BY: <i>William</i> DATE: 1-28-73	MODIFIED BY: DATE: <i>William</i> SEP. 1973
FORT PECK LAKE, MONTANA SPILLWAY SLOPE EXCAVATION TIME MOVEMENT 63-347 STA 13+00	
APPROVED BY: <i>Alfred H. Brubaker</i> DATE: 1-28-73	DATE TO BE SUBMITTED: SEP. 1973

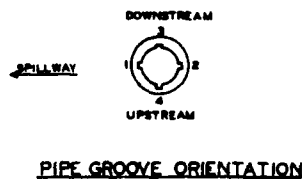
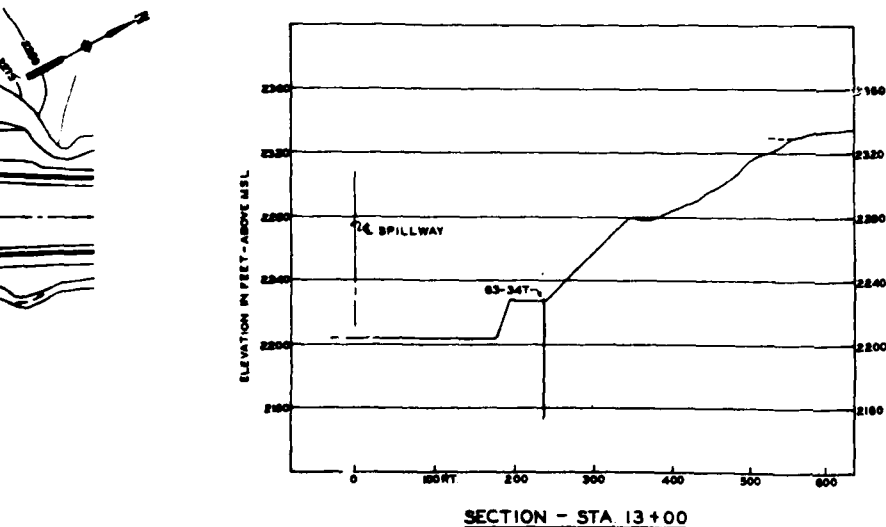
CONSTRUCTION FOUNDATION REPORT

PLATE 112





VS DEFLECTION



THIS DRAWING HAS BEEN REDUCED TO
THREE-EIGHTHS THE ORIGINAL SCALE.

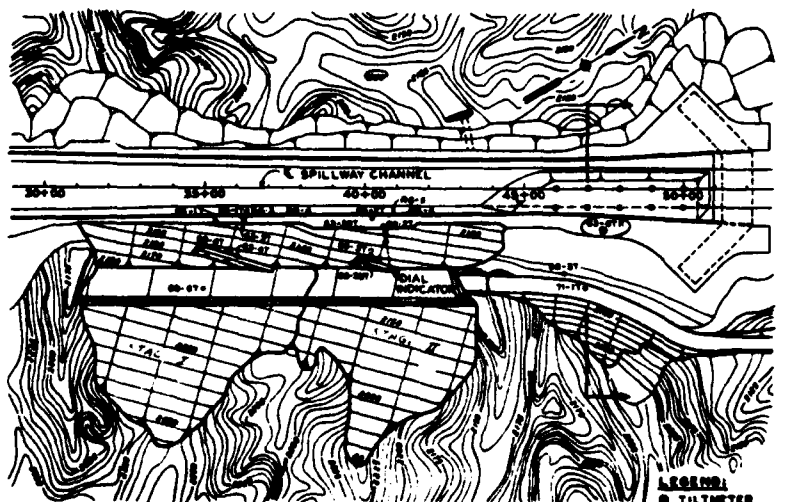
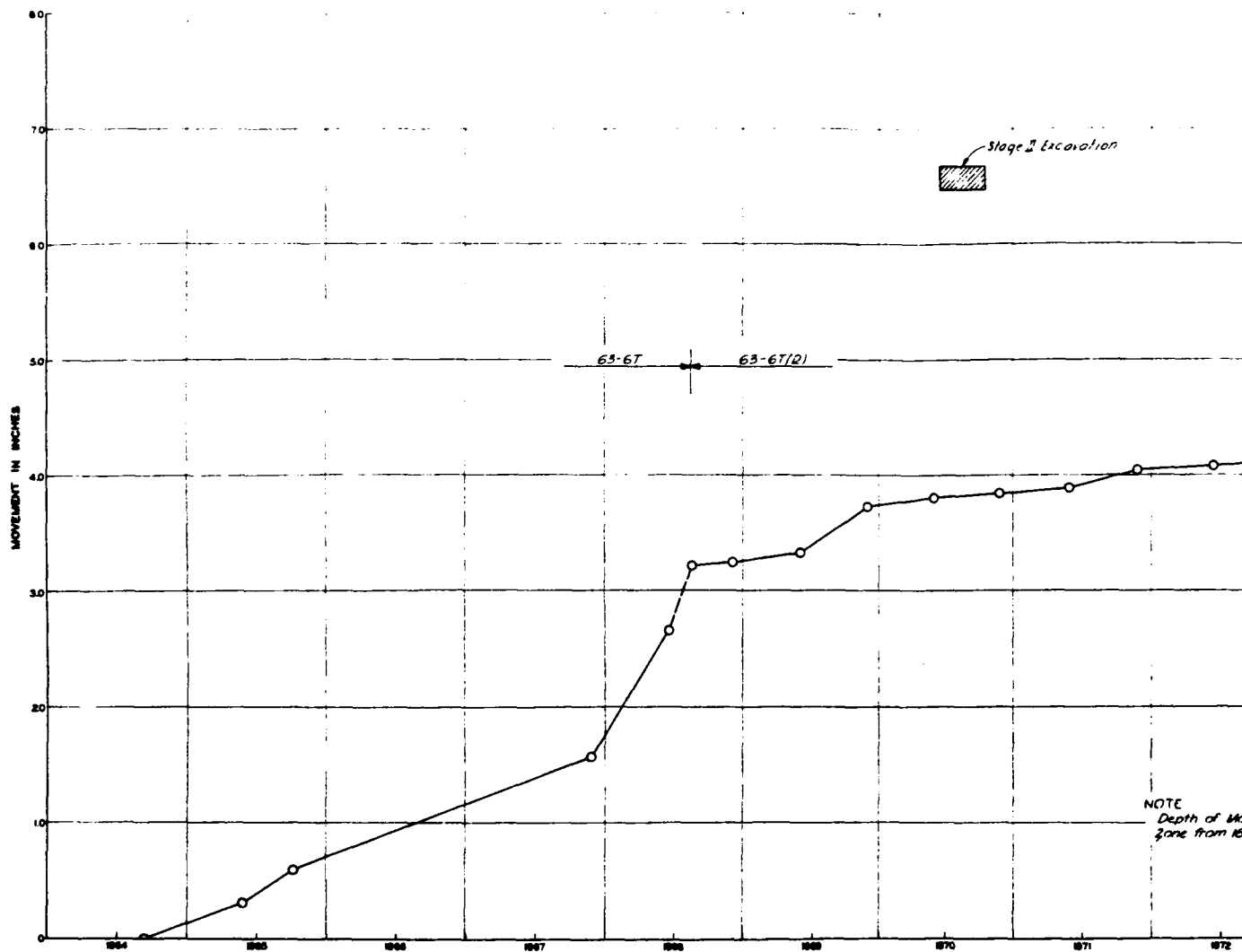


THIS PLAN AGREEMENTS CONTRACT NO.
MODIFICATION NO.

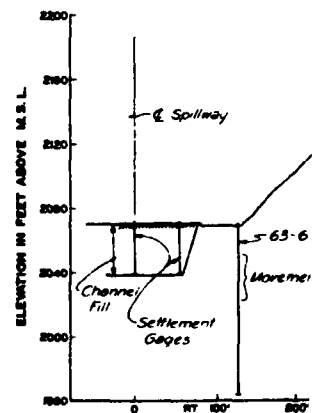
U. S. ARMY ENGINEER DISTRICT, OMAHA GROUP OF ENGINEERS OMAHA, NEBRASKA	
MISSOURI RIVER FORT PECK LAKE, MONTANA SPILLWAY SLOPE EXCAVATION TILTMETER OBSERVATIONS 63-34T-STA 13: 2.3 RT.	
DESIGNED BY: G.E.A. CHECKED BY: G.E.A. APPROVED BY: <i>Alfred L. Brubaker</i> DATE: 12-3-71	DATE: SEP. 1973 BY: <i>Alfred L. Brubaker</i> CHECKED BY: <i>Alfred L. Brubaker</i>

CONSTRUCTION FOUNDATION REPORT

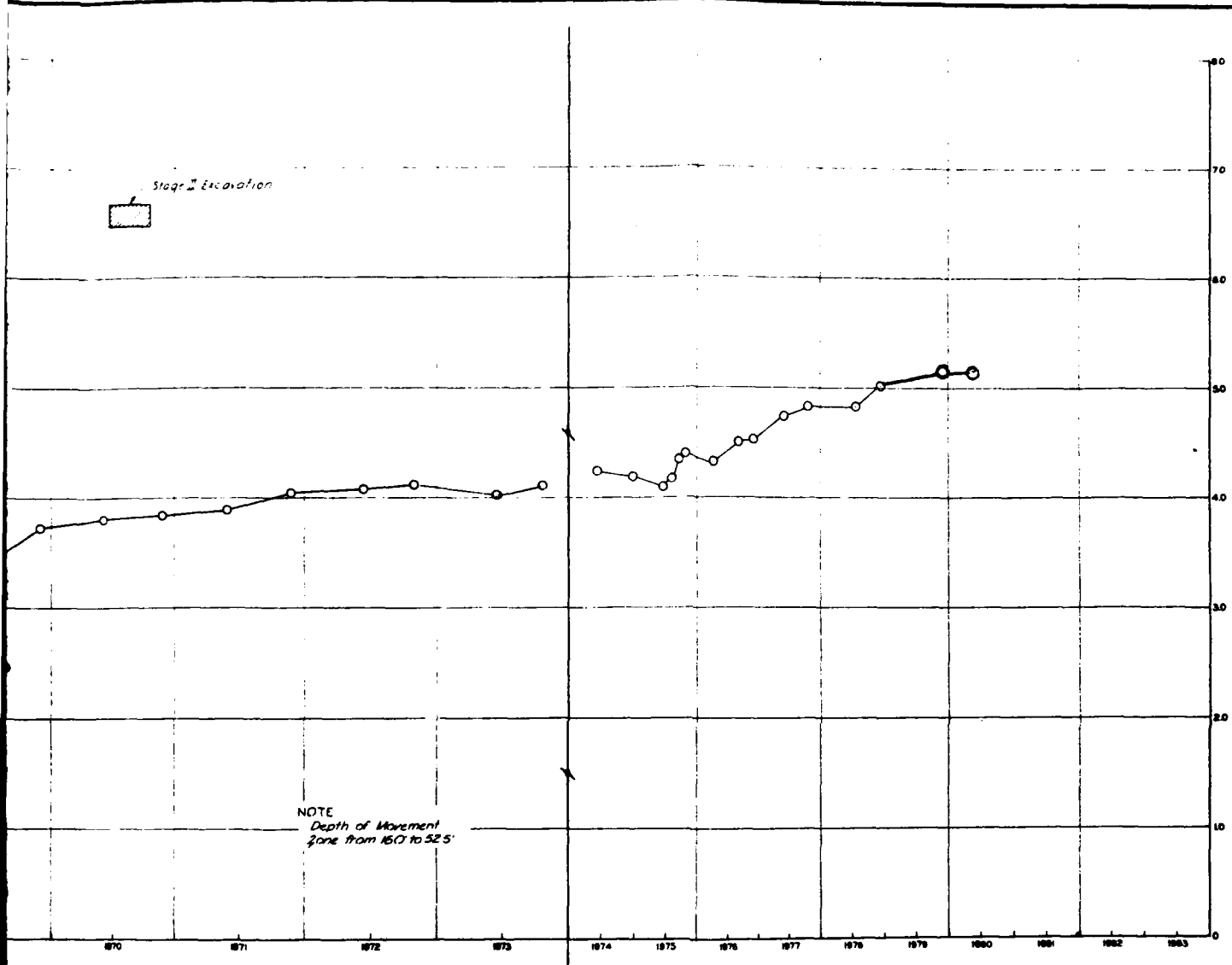
PLATE 113



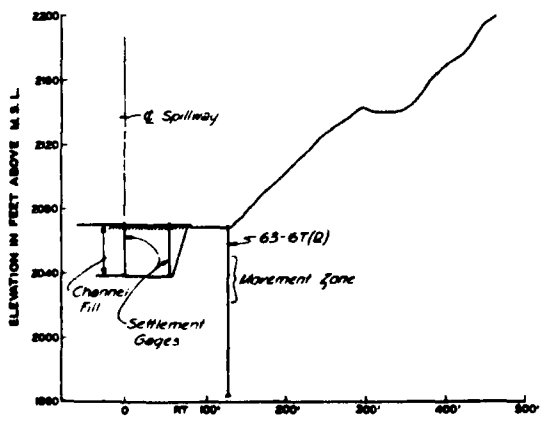
KEY PLAN
 SCALE: 1 INCH = 500 FEET
 200' 0' 200'



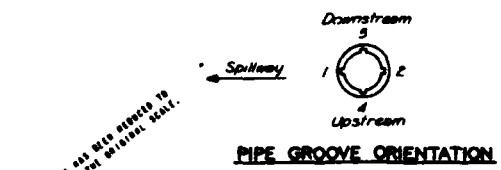
SECTION-S



NOTE
Depth of Movement
Zone from 16.0 to 52.5'



SECTION - STA 47+00



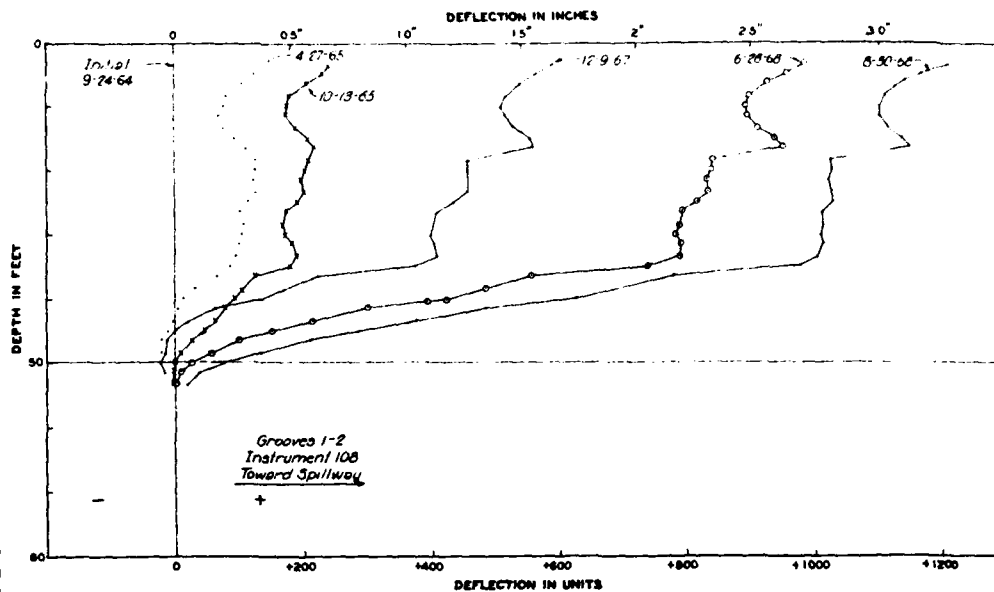
THIS GRAPH HAS BEEN REDUCED TO
1/4\"/>



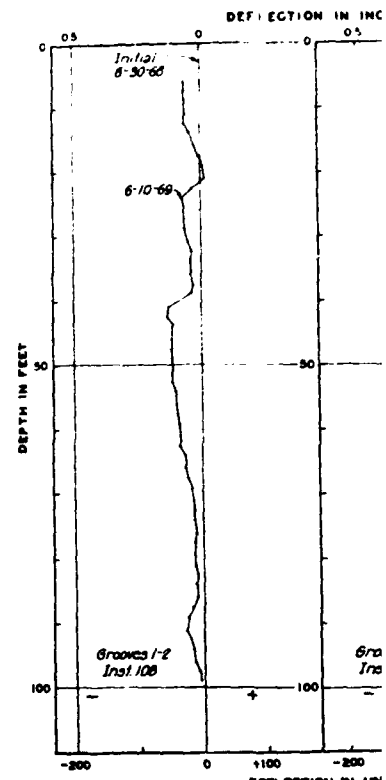
DATE		REVISION		APPROVED
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA				
DESIGNED BY: G.W.A.		CHECKED BY: G.W.A.		
DRAWN BY: M.S.H.		CHECKED BY: C.V.J.		
APPROVED BY: <i>Alfred L. Bradley</i>		DATE: SEP. 1973		
PROJECT: FORT PECK LAKE, MONTANA SPILLWAY SLOPE EXCAVATION		TIME MOVEMENT 63-6T, 63-6T(2), STA 47+80 TO 47+81		
APPROVED BY: <i>Alfred L. Bradley</i>		DATE: SEP. 1973		

THIS PLAN ACCOMPANIES CONTRACT NO. _____
MODIFICATION NO. _____

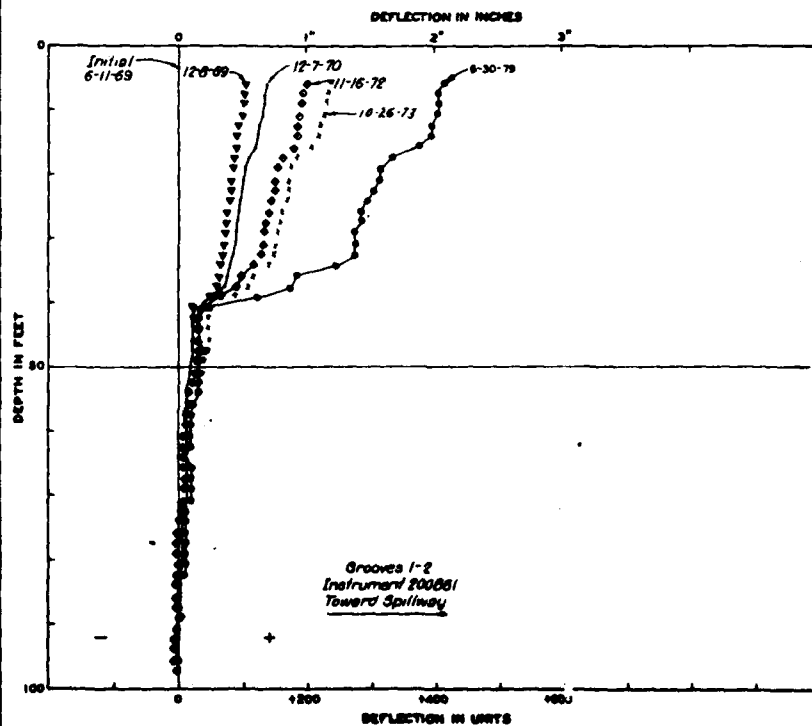
2



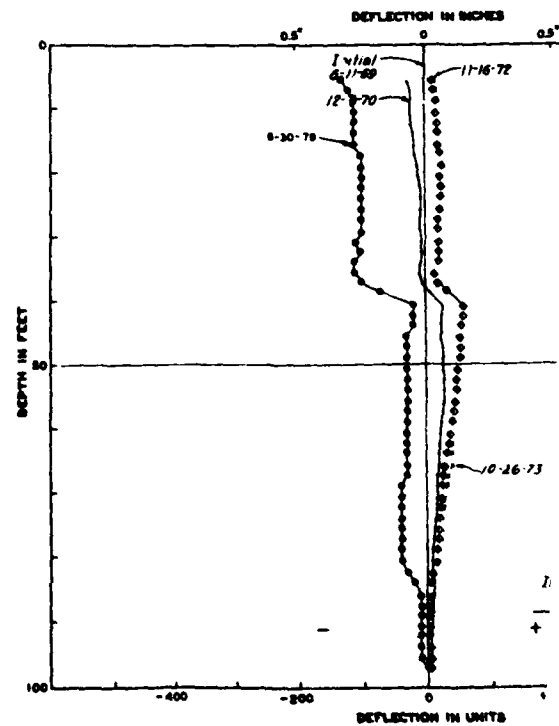
DEPTH VS. DEFLECTION
83-87

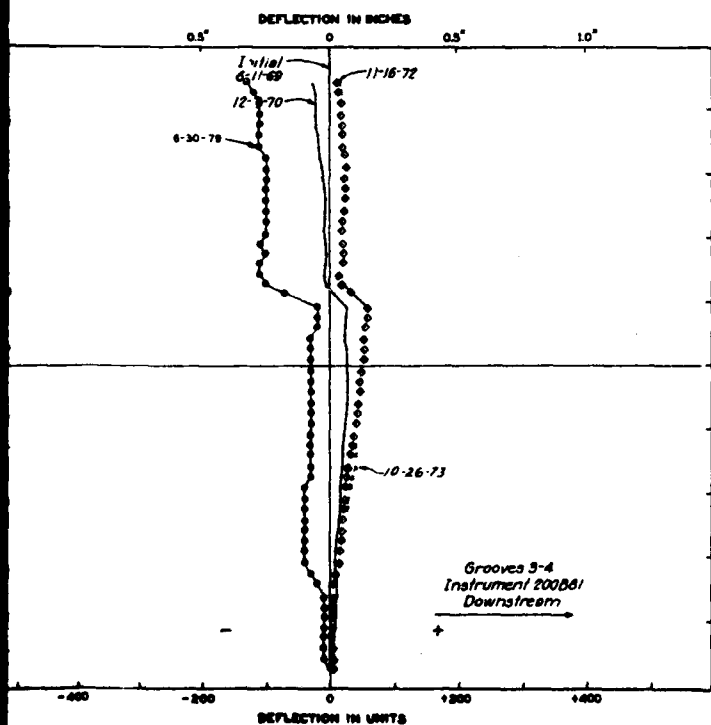
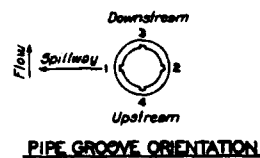
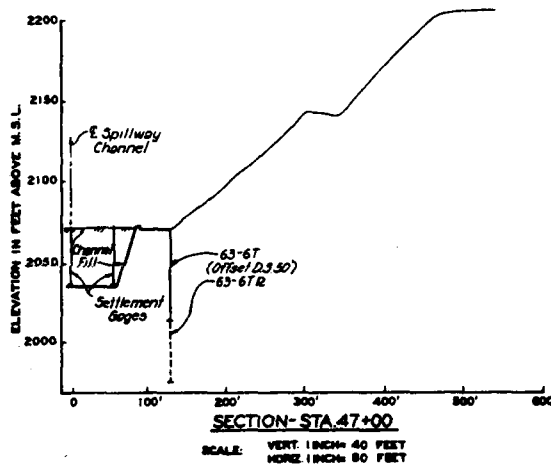
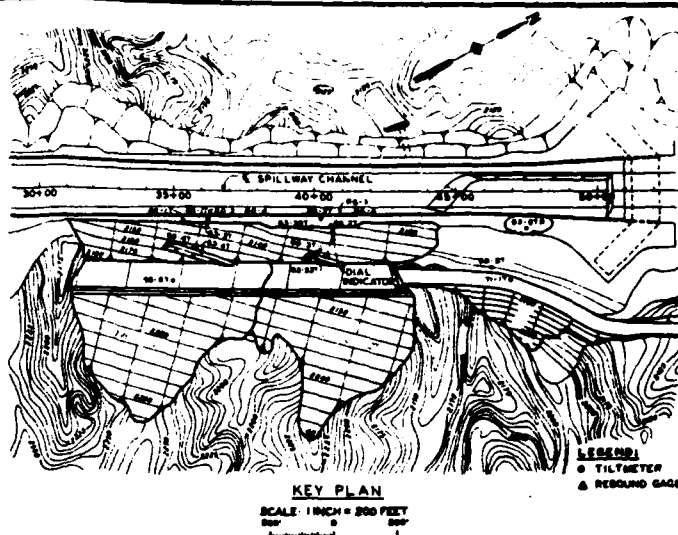
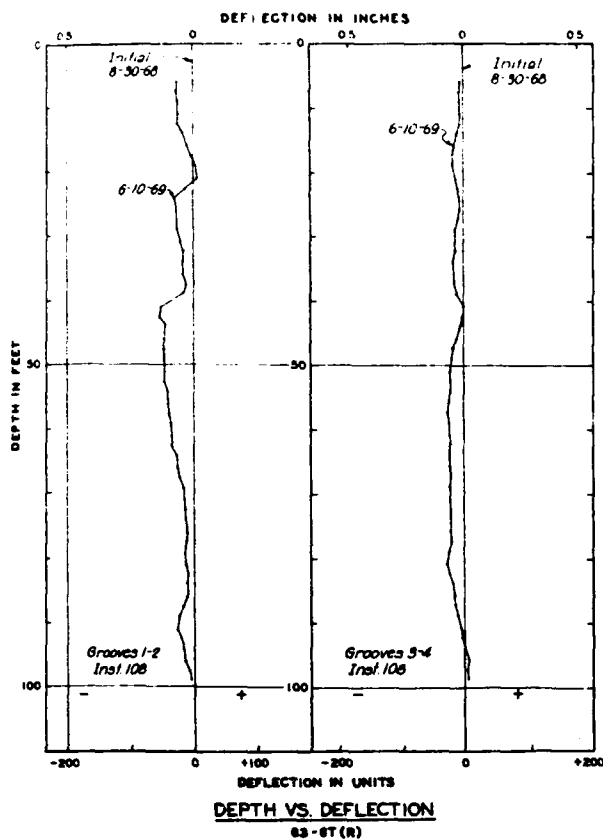


DEPTH VS. DEFLECTION
83-87 (R)



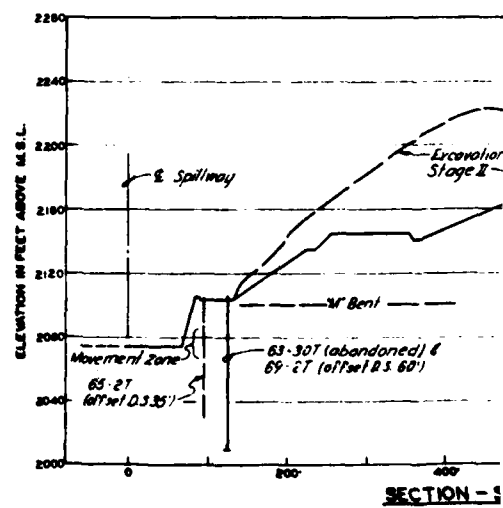
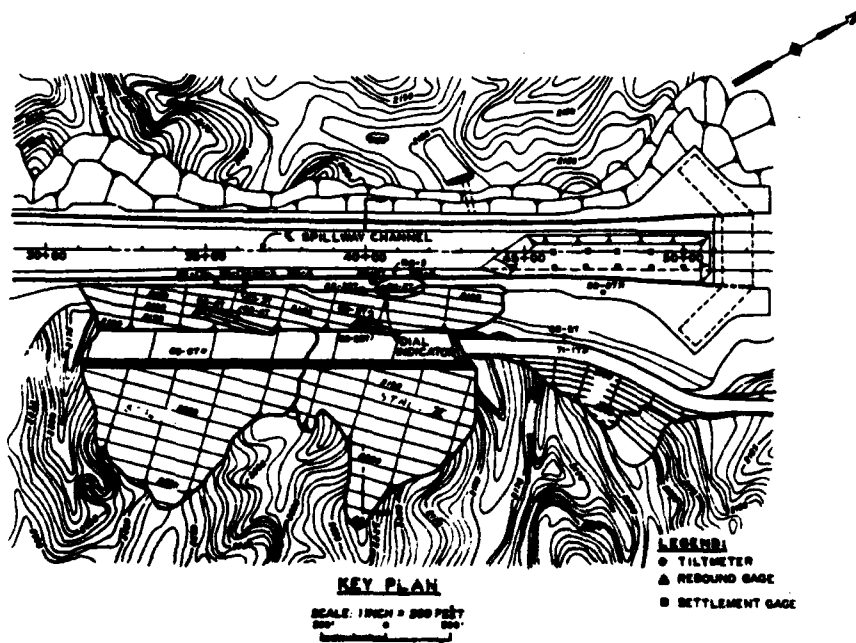
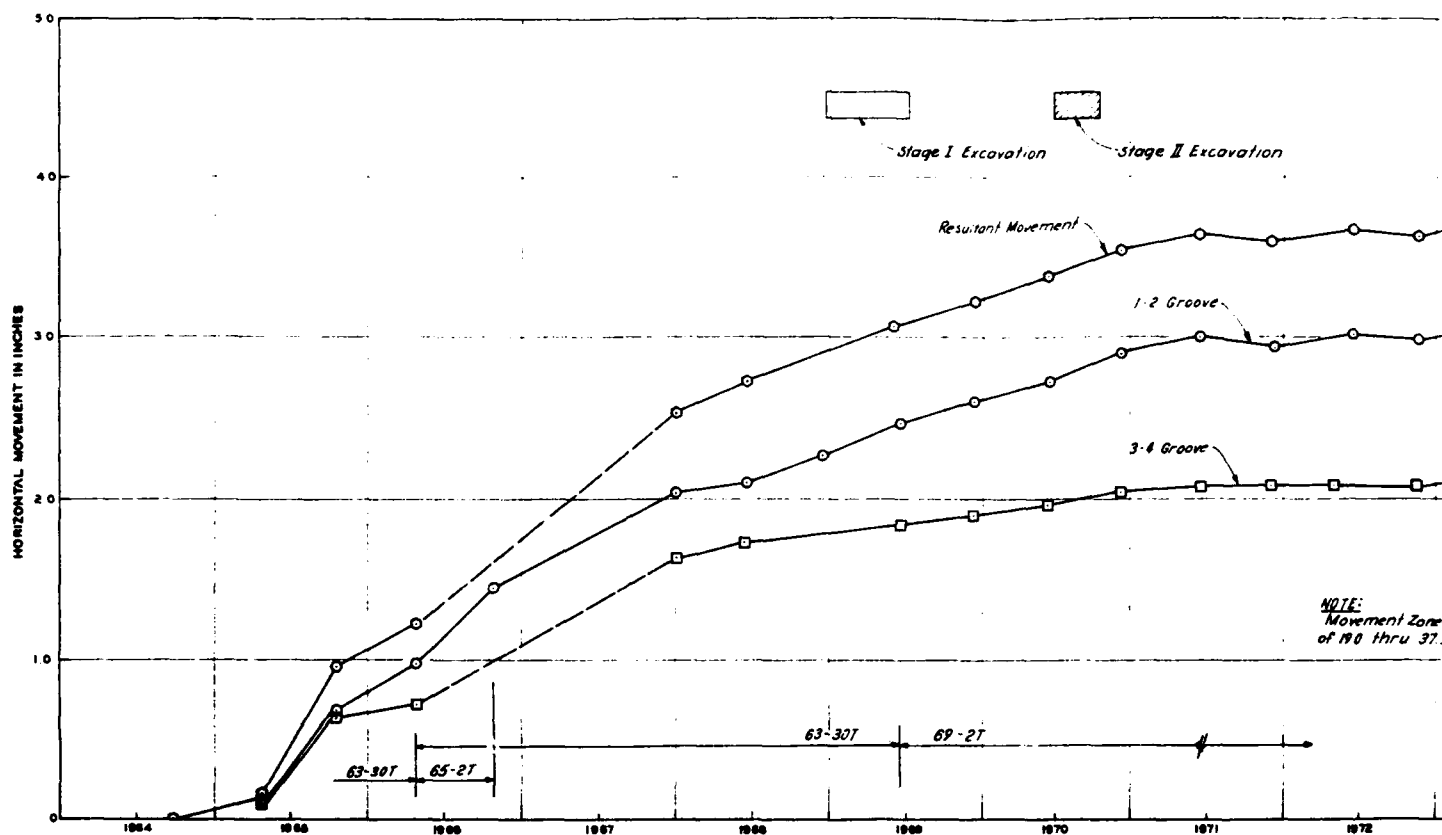
DEPTH VS. DEFLECTION
83-87(2)

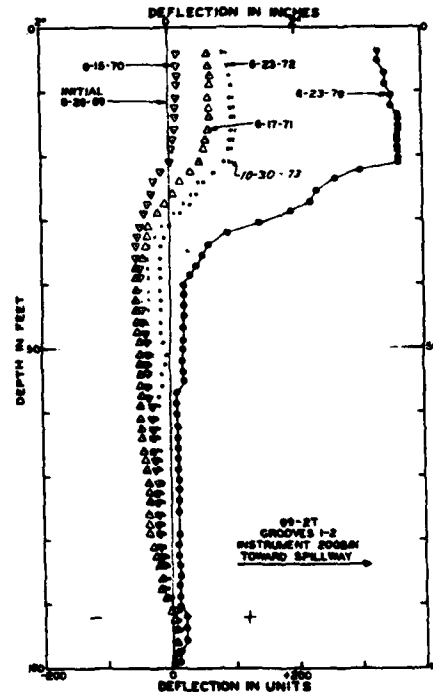
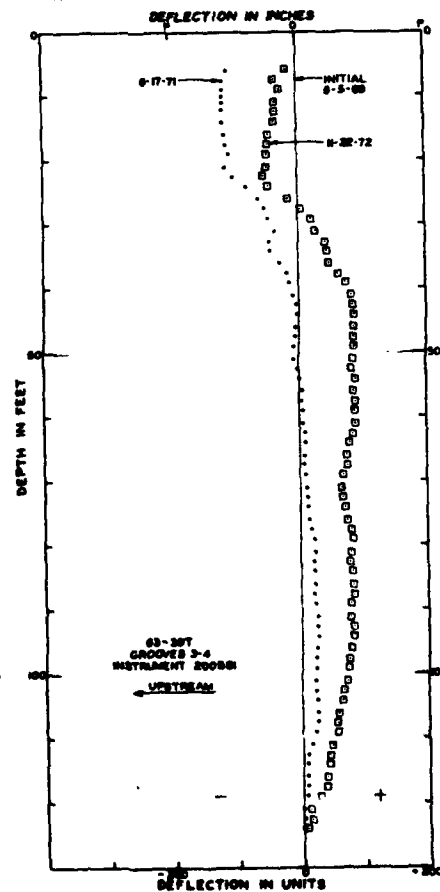
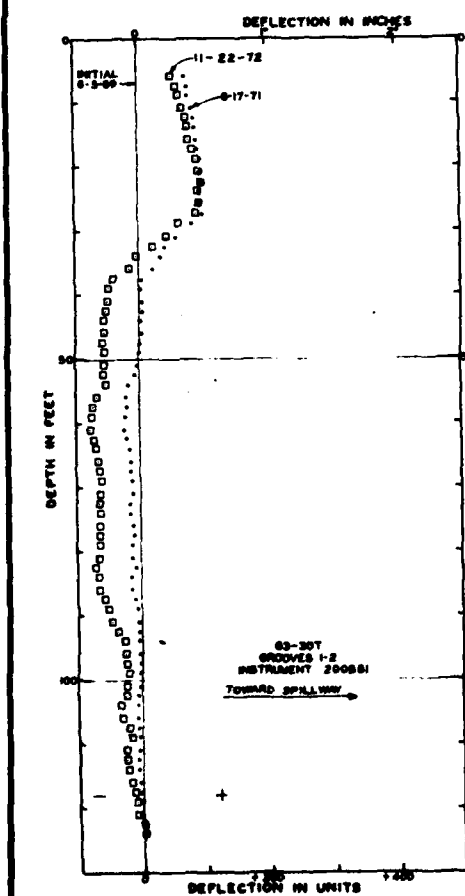
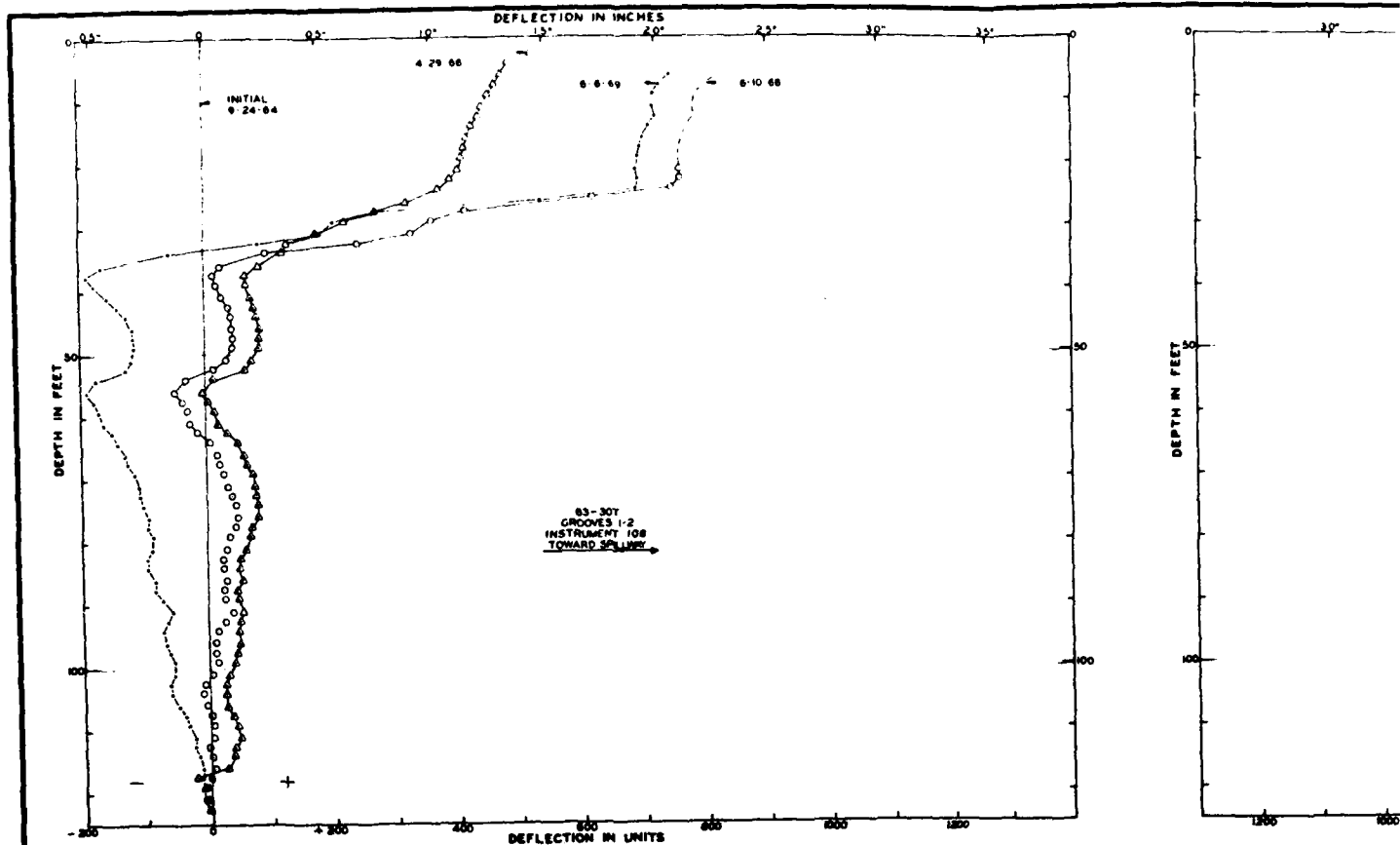


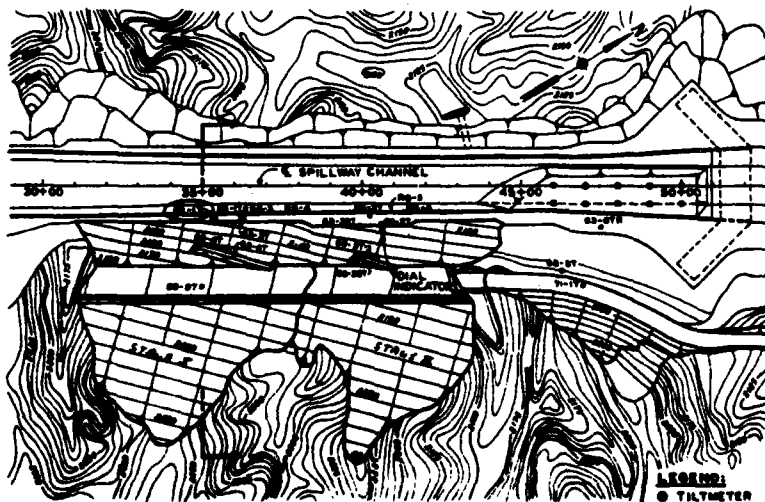
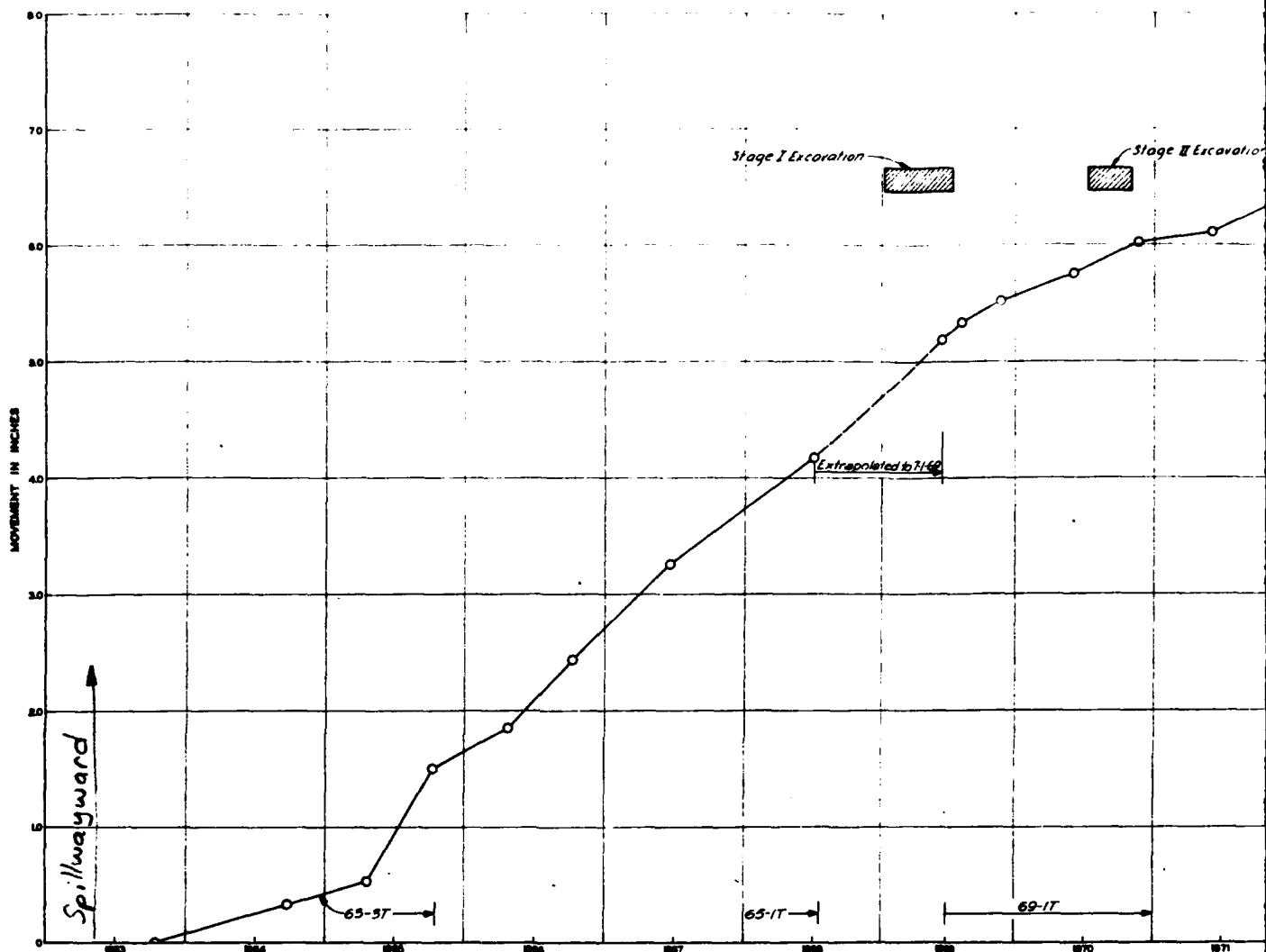


REVISIONS		DATE	DESCRIPTION	BY	APP'D
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA					
DESIGNED BY: C. E. A.		MODIFIED BY: J. E. A.			
CHECKED BY: M. E. A.		APPROVED BY: J. E. A.			
DRAWN BY: J. E. A.		SCALE: 1/4" = 1'-0"			
PROJECT: FORT PECK LAKE, MONTANA SPILLWAY SLOPE EXCAVATION		TILTMETER OBSERVATIONS 63-67 & 65-67(R) - STA. 47+50:130' RT.			
DATE: SEP. 1973		BY: J. E. A.			
CHECKED BY: J. E. A.		APPROVED BY: J. E. A.			
DRAWN BY: J. E. A.		SCALE: 1/4" = 1'-0"			

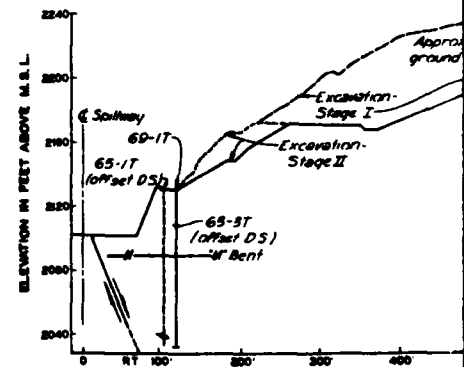




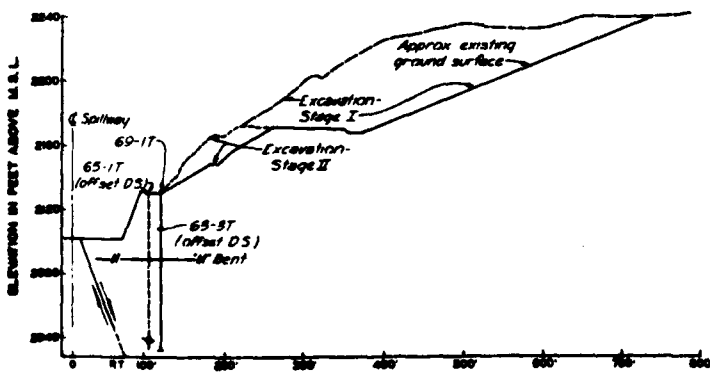
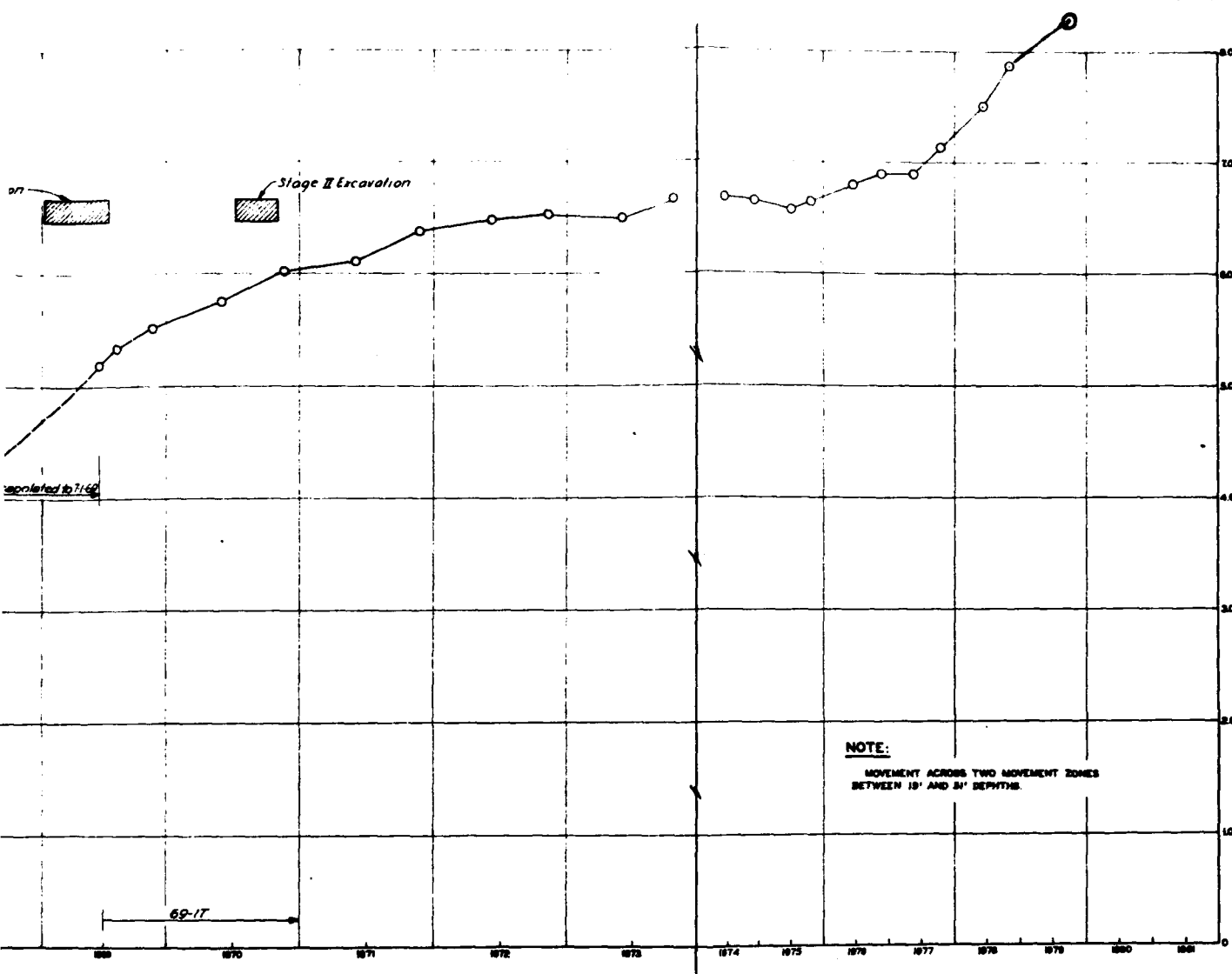




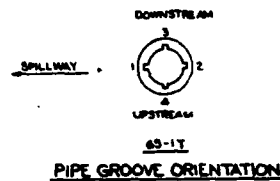
KEY PLAN
SCALE: HORIZ. 1" = 200 FEET
VERT. 1" = 10 FEET



SECTION - STA 34



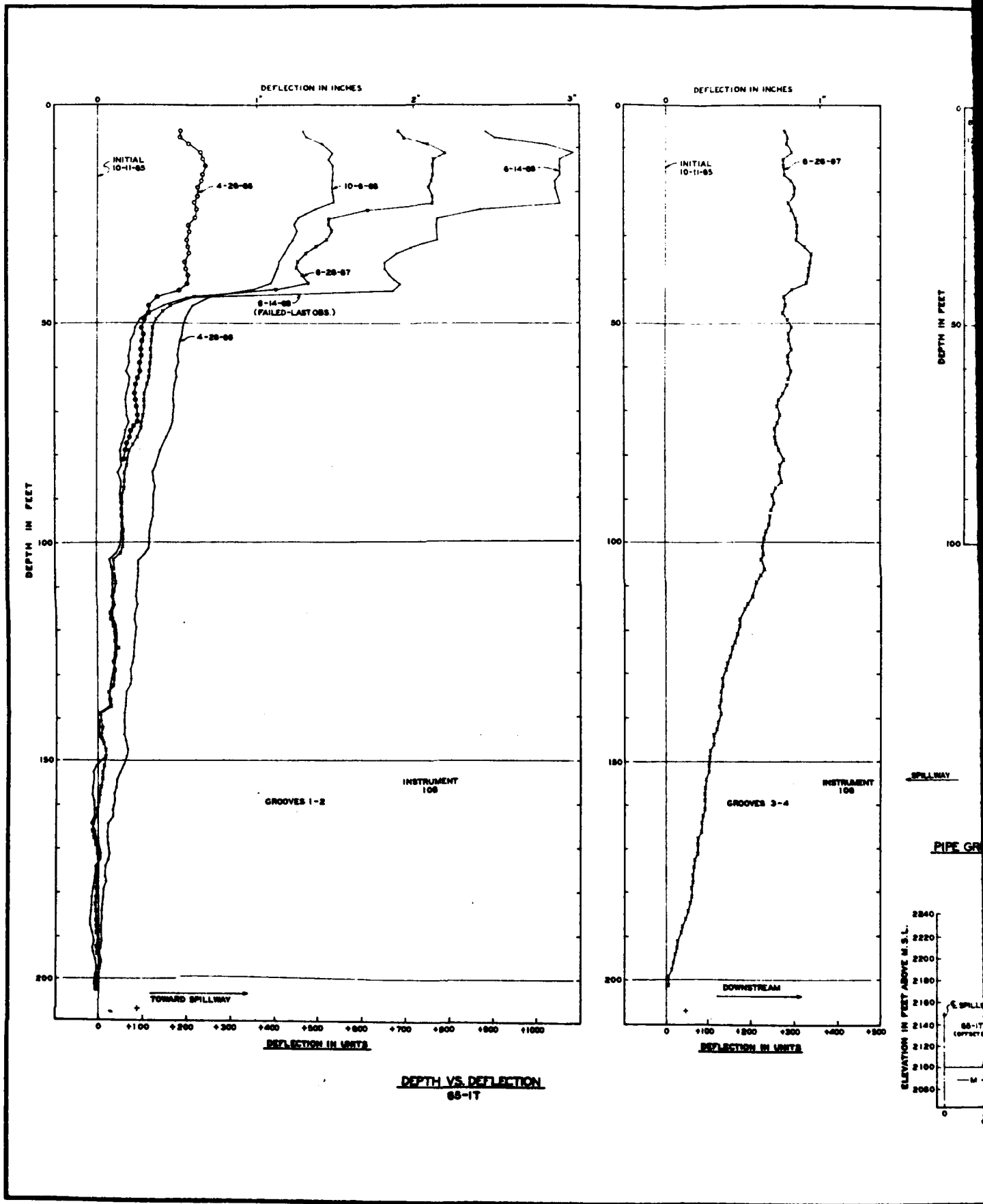
THIS DRAWING HAS BEEN REDUCED TO
THREE-FIFTHS THE ORIGINAL SCALE.

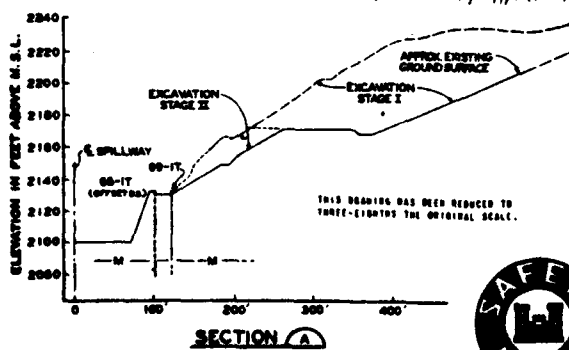
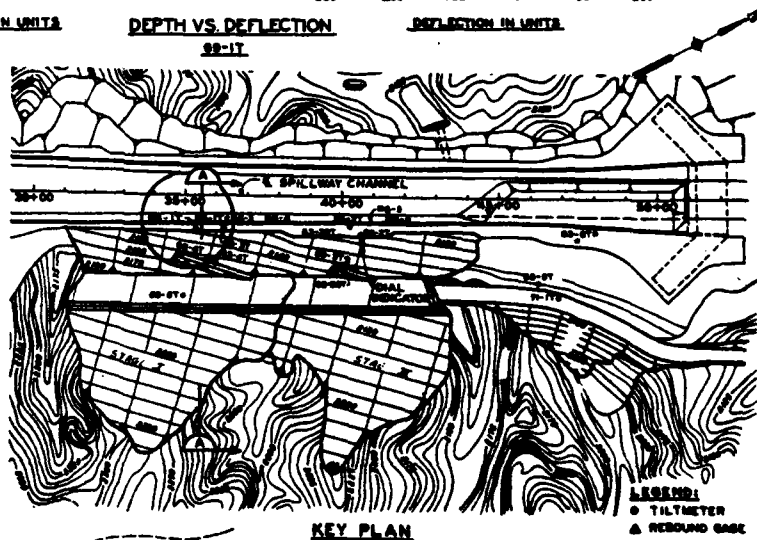
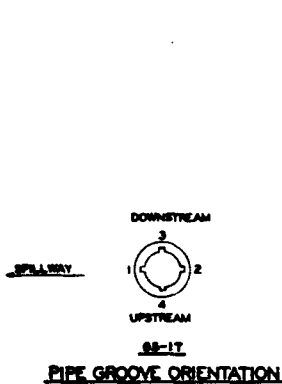
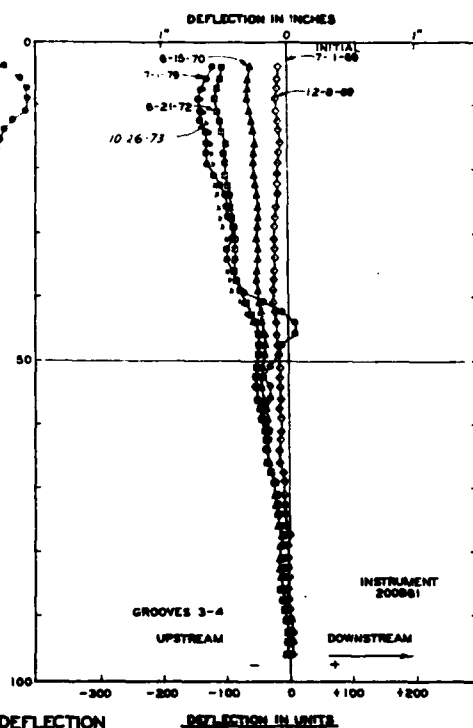
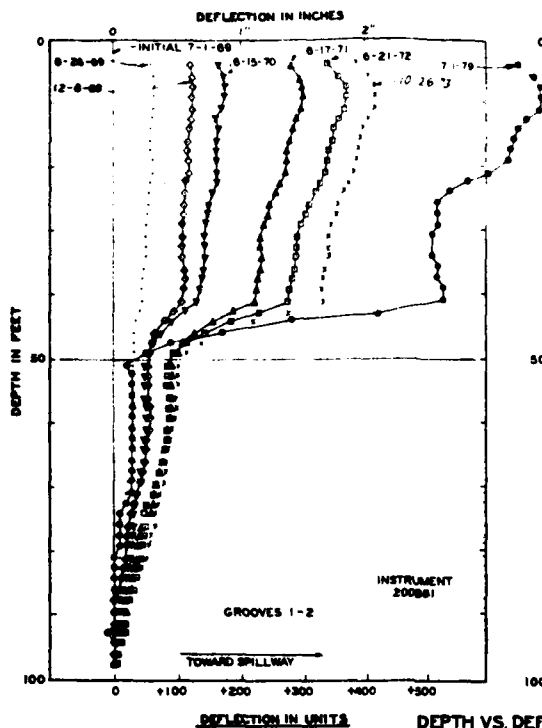
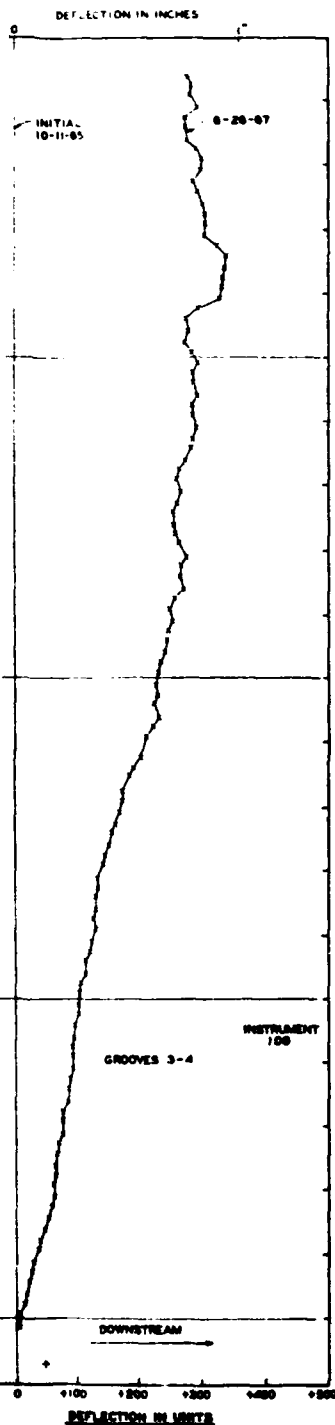


U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA	
FORT PECK LAKE, MONTANA SPILLWAY SLOPE EXCAVATION	
TIME MOVEMENT 63-ST, 65-IT & 66-IT	
DATE SEP. 1973	BY Alfred D. Brilling
CHECKED BY Alfred D. Brilling	

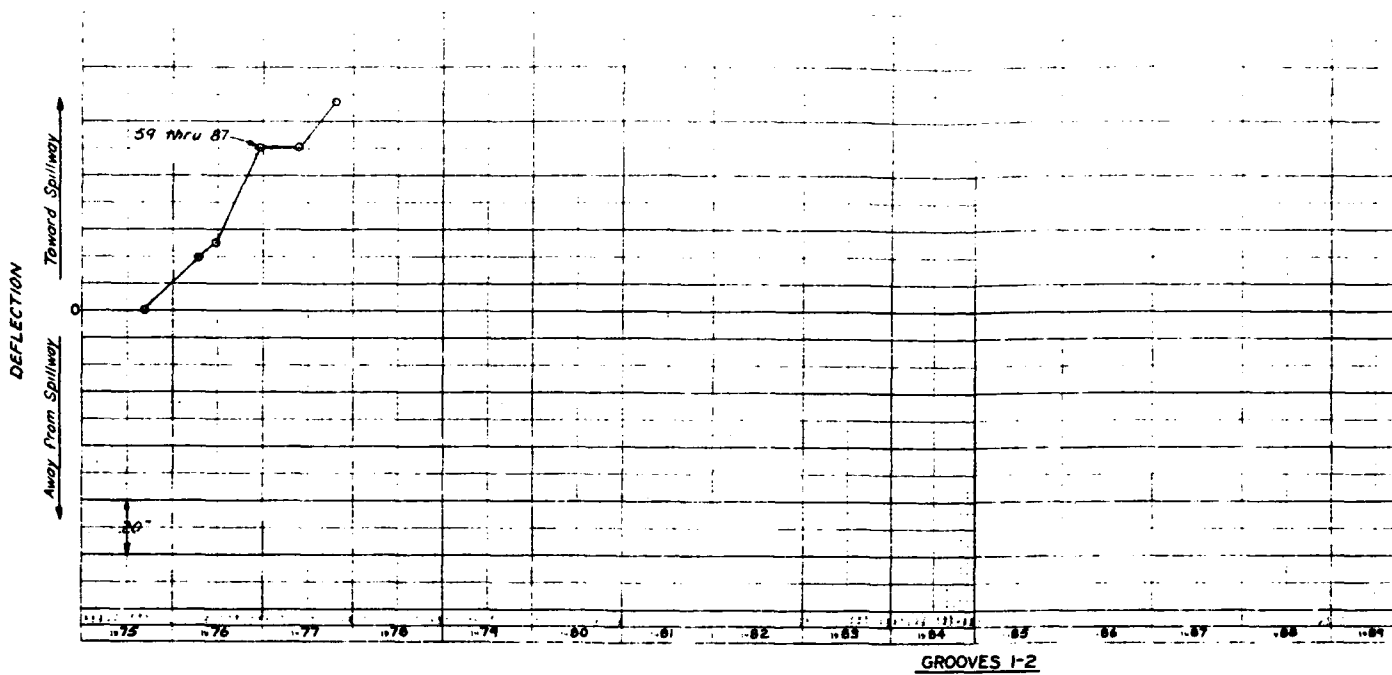
CONSTRUCTION FOUNDATION REPORT

PLATE 118

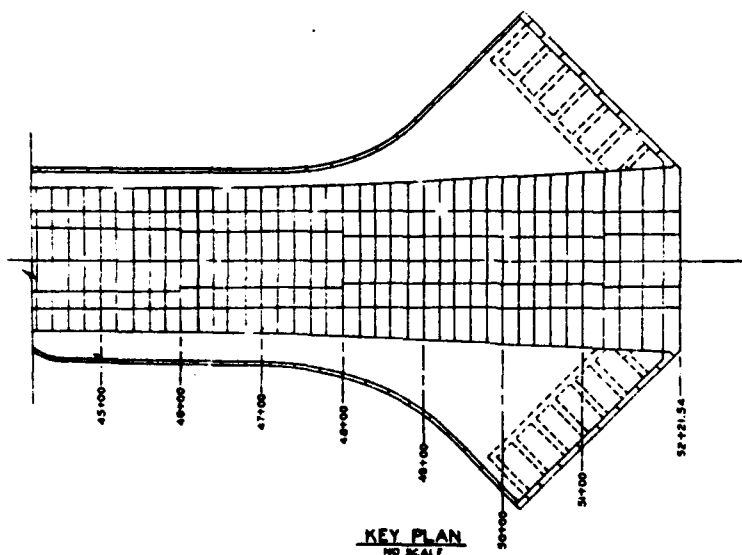


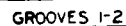


U. S. ARMY ENGINEER DISTRICT, OMAHA GROUP OF ENGINEERS OMAHA, NEBRASKA	
MISSOURI RIVER FORT PECK LAKE, MONTANA SPILLWAY SLOPE EXCAVATION TILTMETER OBSERVATIONS 88-17 AND 89-17	
DESIGNED BY: C. V. J.	DATE: SEP. 1973
CHECKED BY: C. V. J.	DATE: SEP. 1973
APPROVED BY: C. V. J.	DATE: SEP. 1973
THIS PLAN ASSUMES CONTRACT NO. _____ MODIFICATION NO. _____	

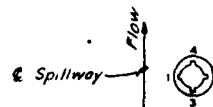


Tiltmeter 75-127





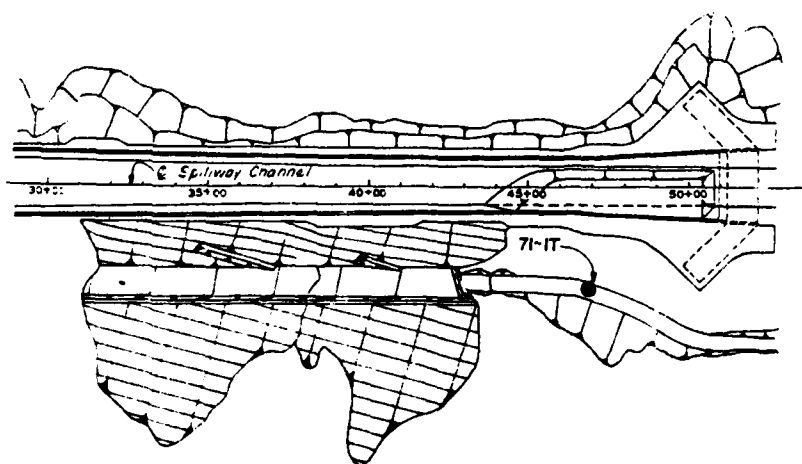
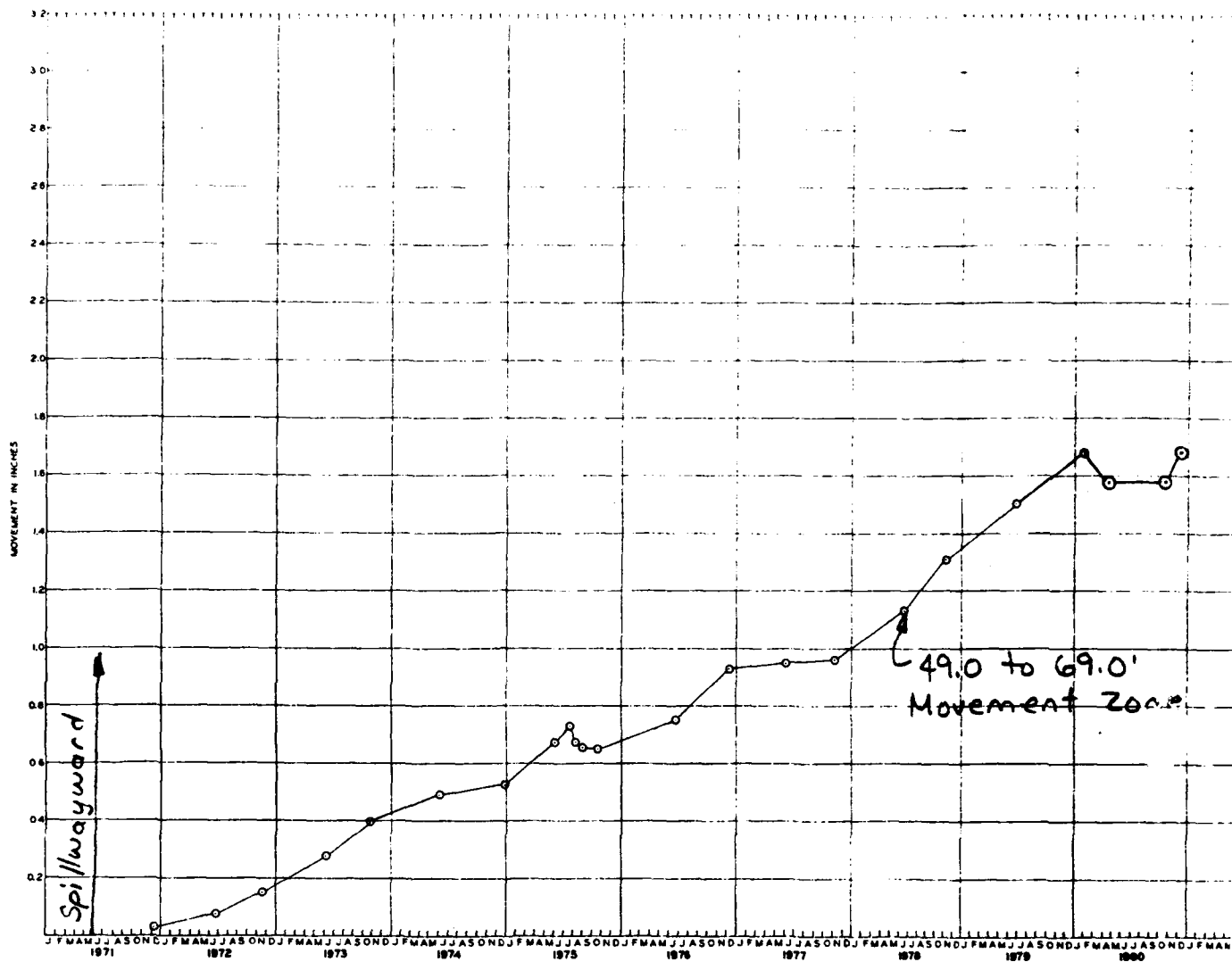
THIS DRAWING HAS BEEN REDUCED TO
THREE-EIGHTHS THE ORIGINAL SCALE.



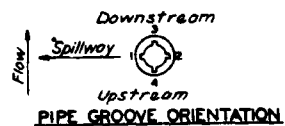
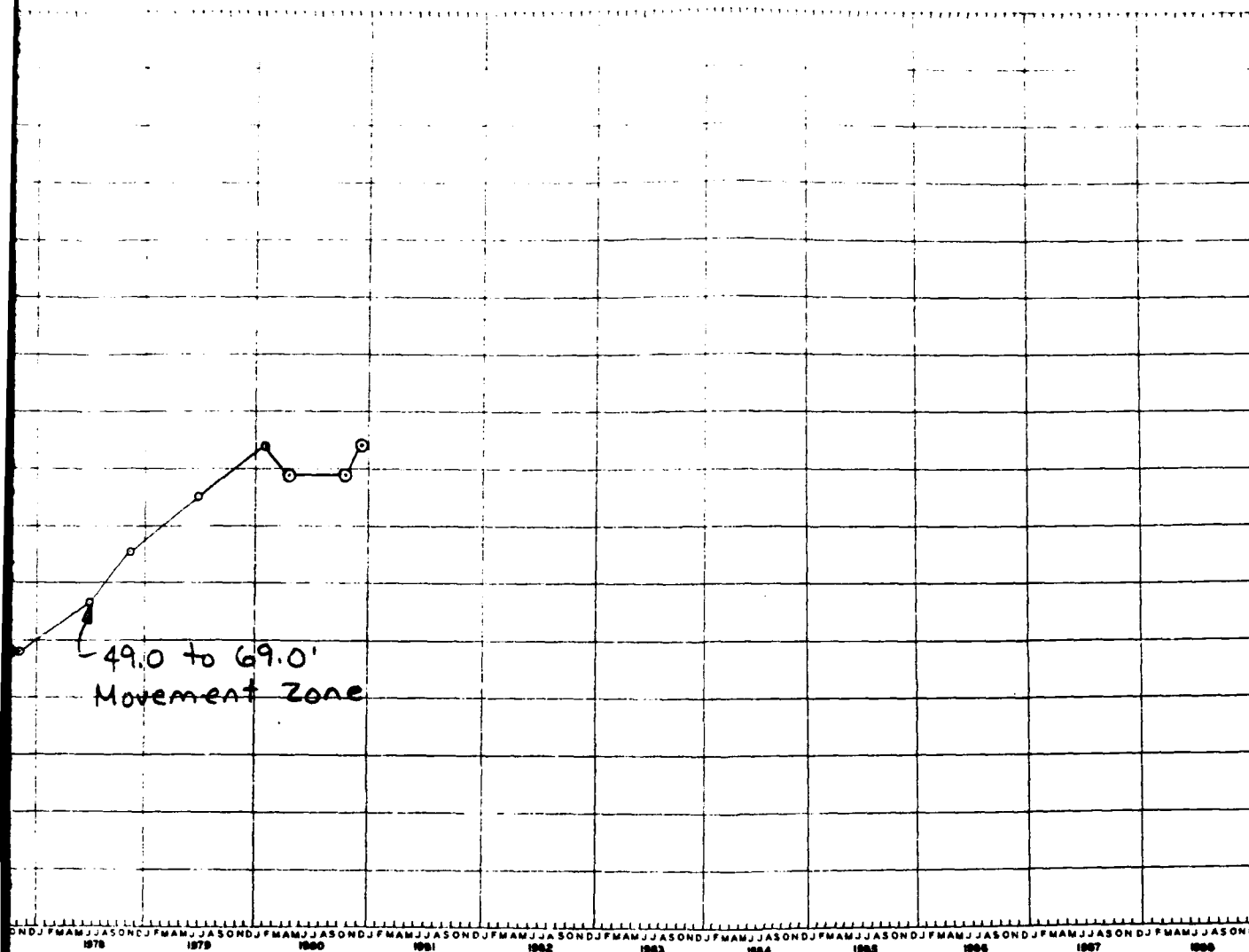
PIPE GROOVE ORIENTATION

[illegible]

THIS PLAN ACCOMPANIES CONTRAST NO.
MODIFICATION NO.



KEY PLAN
SCALE 1 INCH = 500 FEET



THIS DRAWING HAS BEEN REDUCED TO
THREE-EIGHTHS THE ORIGINAL SCALE.



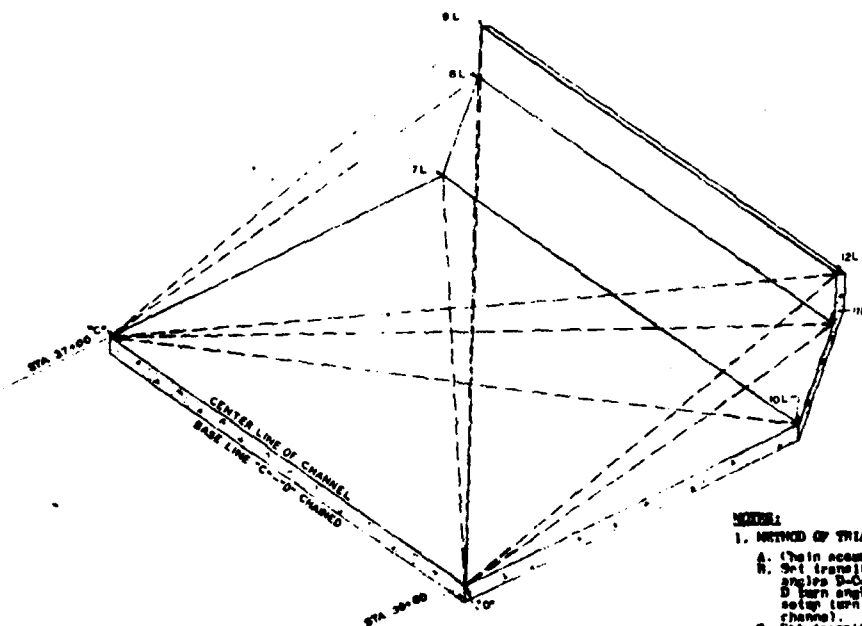
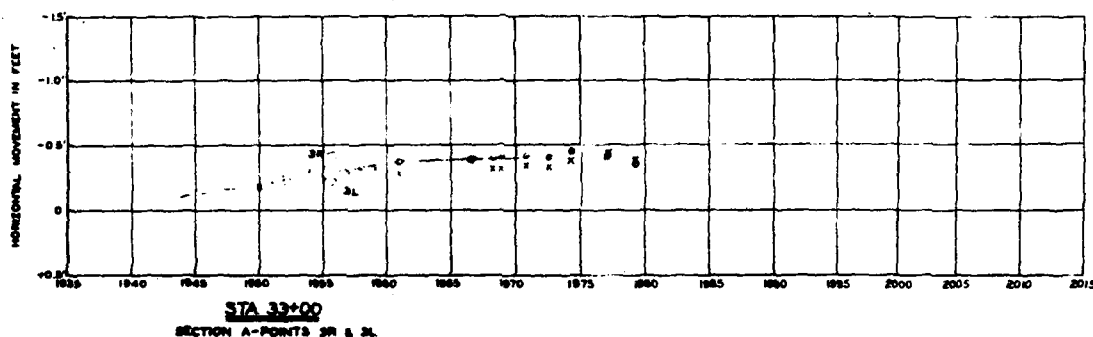
THIS PLAN ASSUMES CONTRACT NO. _____
MODIFICATION NO. _____

U. S. ARMY ENGINEER DISTRICT, OMAHA GROUP OF ENGINEERS OMAHA, NEBRASKA	
PROJECT NO. _____	MISSOURI RIVER FORT PECK DAM TILTMETER OBSERVATIONS SLOPE INDICATOR 71-IT INSTRUMENT-200 B DEFLECTION IN TIE
DESIGNED BY _____	DATE _____
CHECKED BY _____	DATE _____
APPROVED BY _____	DATE _____

CONSTRUCTION FOUNDATION REPORT

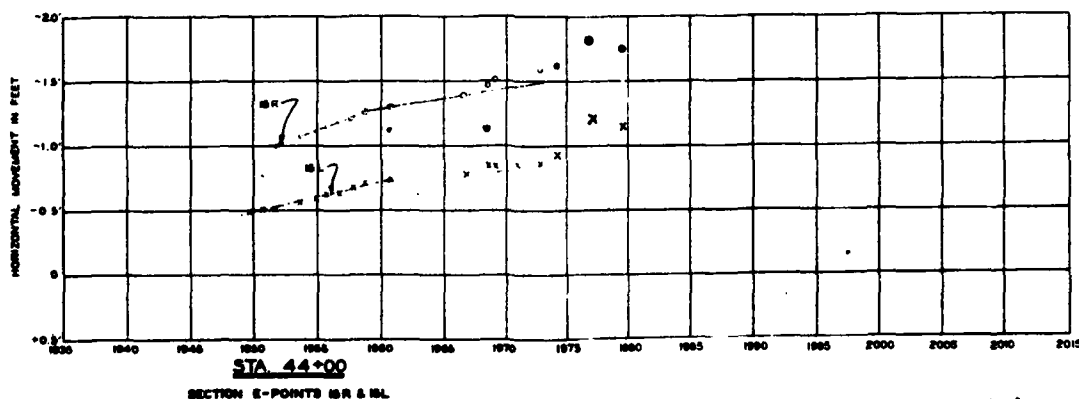
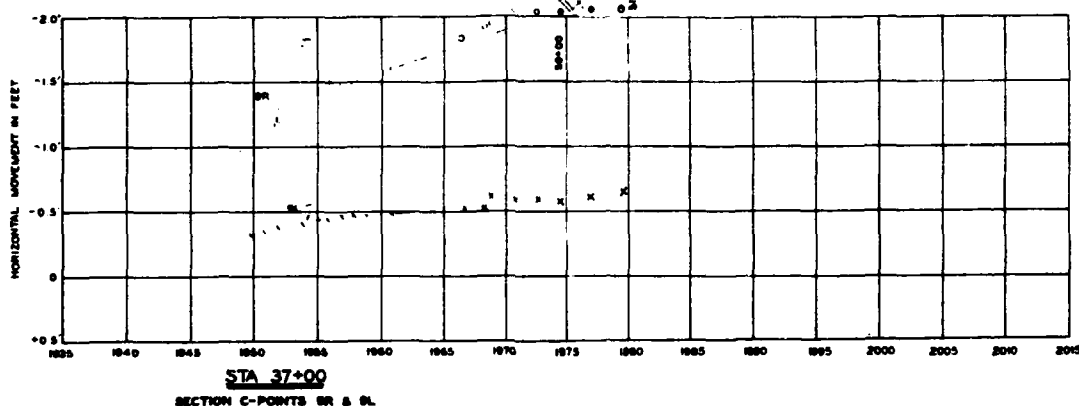
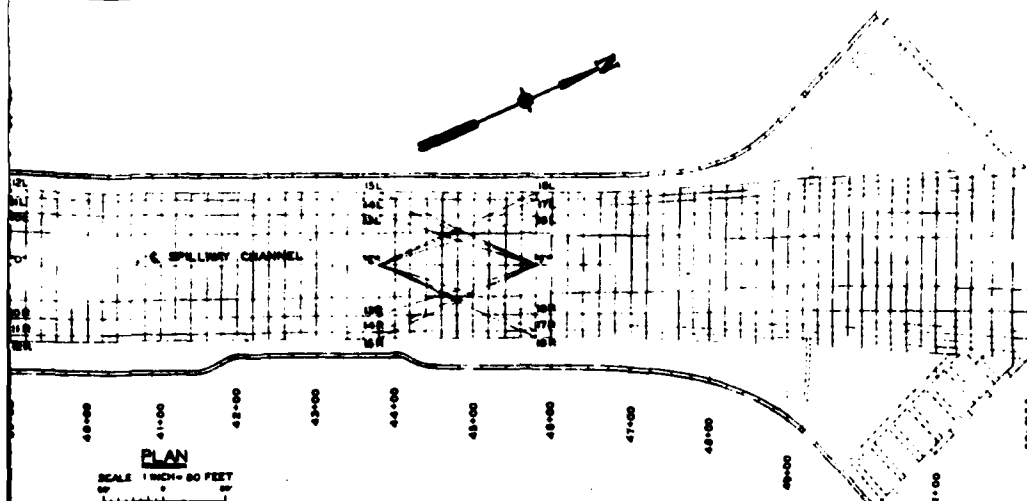
2 PLATE 121

A. M. C. A. N. S.	
Conf / And In With Dates From To	
ADDRESS IN	
CITY	
STATE	
MEMBERSHIP	
DATE	



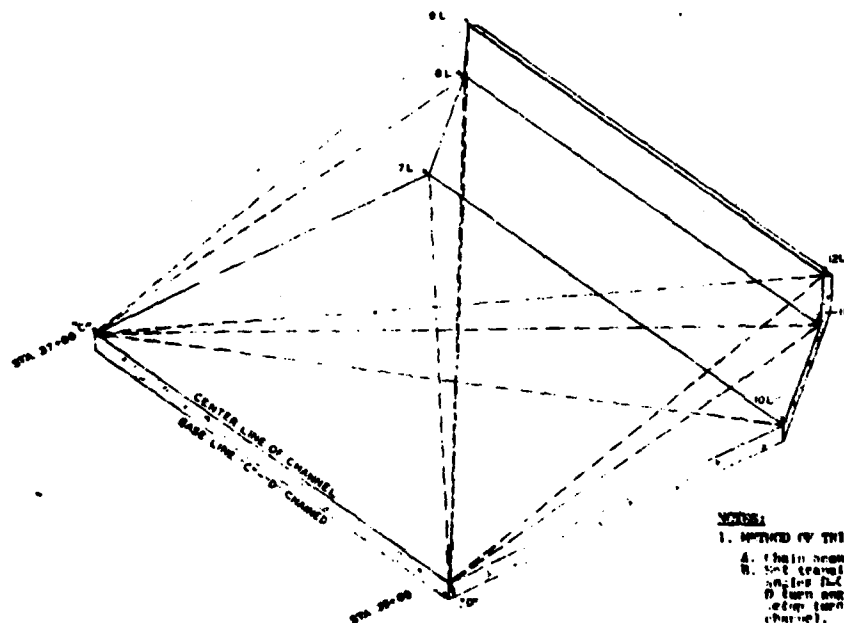
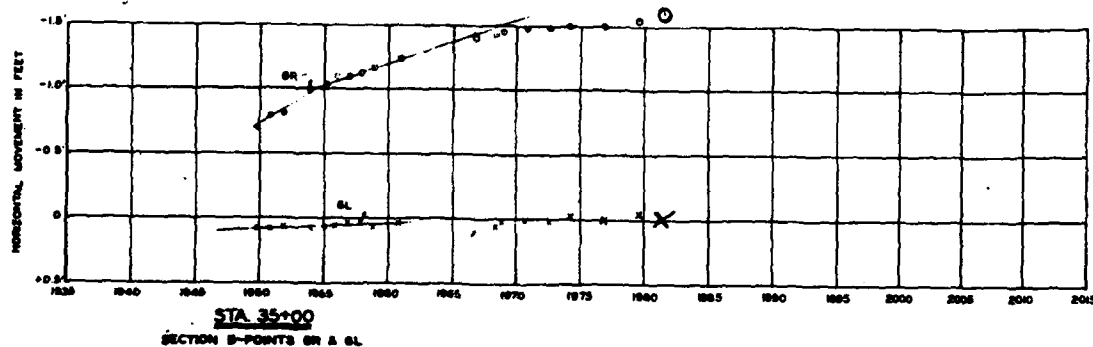
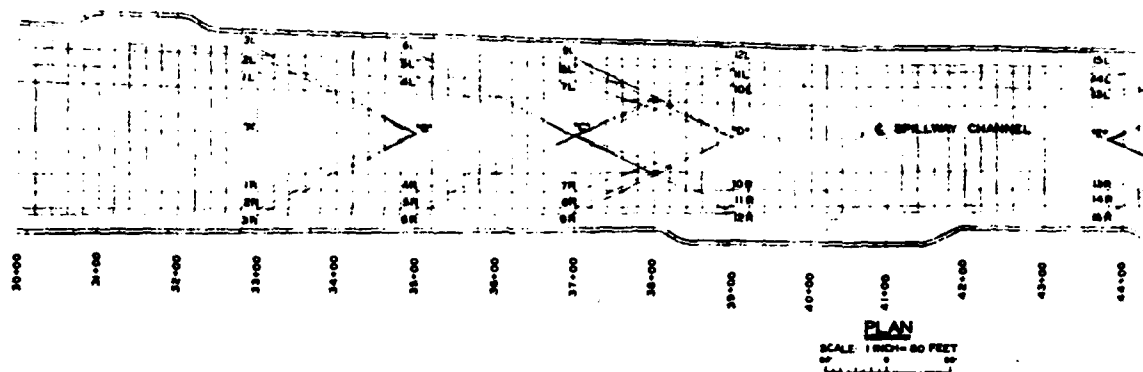
DETAIL
ISOMETRIC VIEW OF LEFT SIDE OF SILLARY
CHANNEL BETWEEN STA. 37+00 & STA. 39+00
SHOWING METHOD OF TRIANGULATION

- ### 1. METHOD OF TRIANGULATION:
- A. Chain accurately base line C-B.
 - B. Set transit on point C, back sight to point B, then turn angles B-C-A, D-C-B, E-C-F, again back sighting to point B, then turn angles A-B-C, D-B-E, F-B-G, in this way setting turn the corresponding angles on the right side of channel.
 - C. Set transit at point B, back sight to point C, and turn angles C-B-D, D-B-E, E-B-F, F-B-G, likewise turn angles C-B-H, C-D-H, D-E-H, and corresponding angles on right side of channel from same side.
 - D. Close angles by closing traverse pending recorded.
2. Inverse chain by graphs to change in distance (subtangent) between well points on right & left side of the channel.



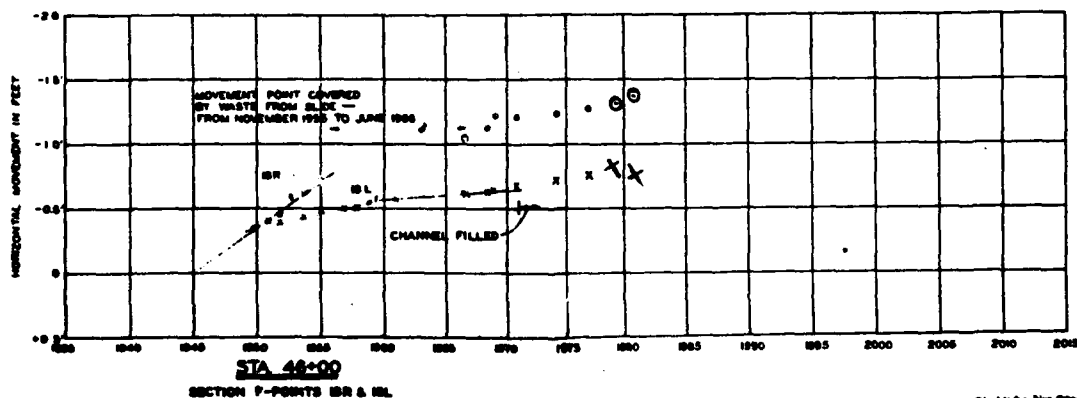
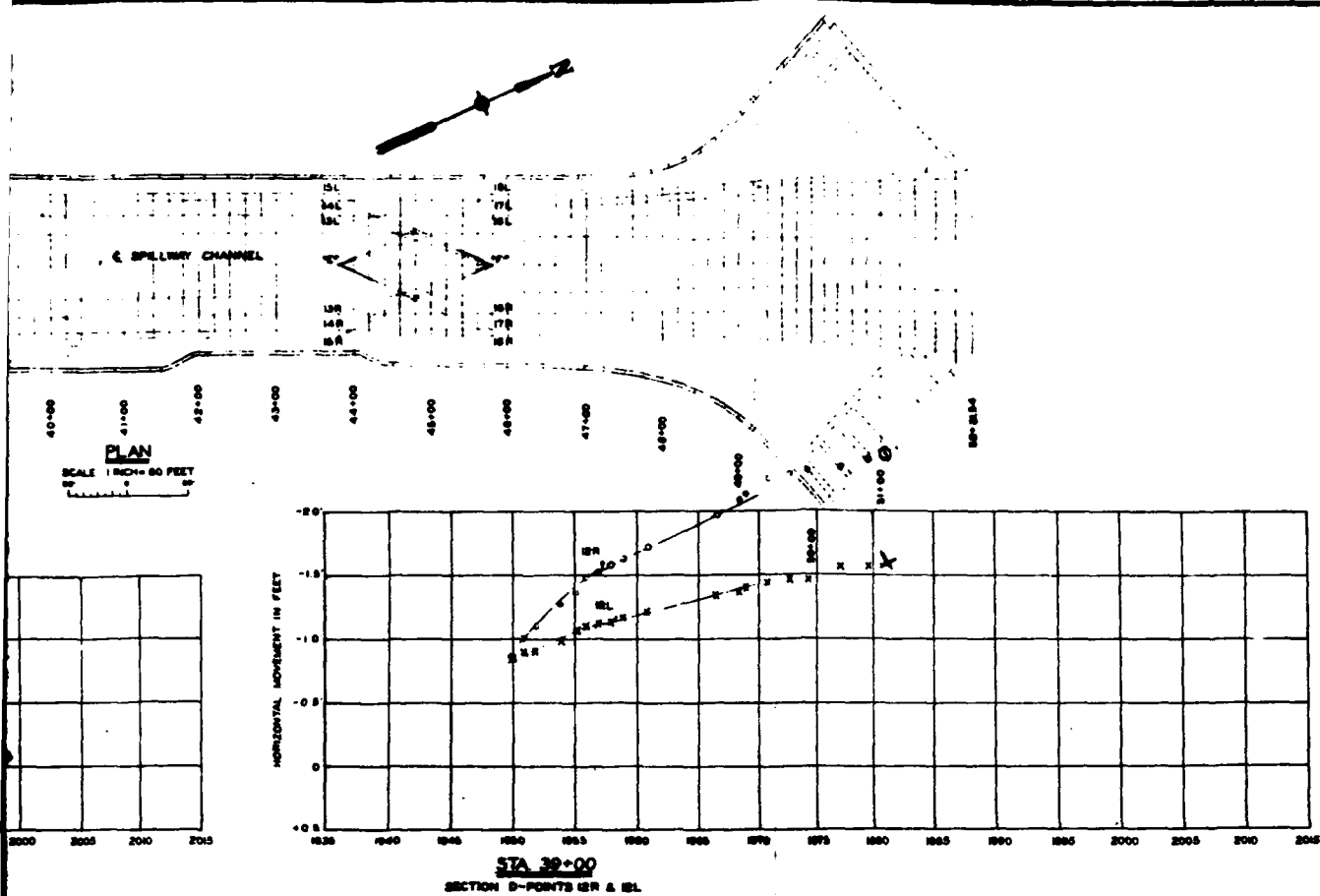
TRIANGULATION:
accurately base line C-D.
Sight on point C, take sight to point B, then turn
angle $\angle C-B-A$, $\angle C-B-H$ again, sighting to point
angle $\angle B-C-H$, $\angle B-C-I$, and $\angle B-C-J$, being care
turn the corresponding angles on the right side of
the point of point B, sighting to point C and turn
angle $\angle C-B-A$, $\angle C-B-H$, $\angle C-B-I$, sighting turn angles
angle $\angle C-B-A$, $\angle C-B-H$, and corresponding angles on right
channel from each point
angle turn the corresponding average reading recorded.
then or graphs to change in distance (shortening)
angle $\angle C-B-A$ on the right side of the channel.

[illegible]

[illegible]

DETAIL
 TO LOCATE AREA OF LEFT OF THE TOWER
 THAT IS RETAINED DIA. FROM 1 ST. DICE
 SHOWING METHOD OF TRIANGULATION

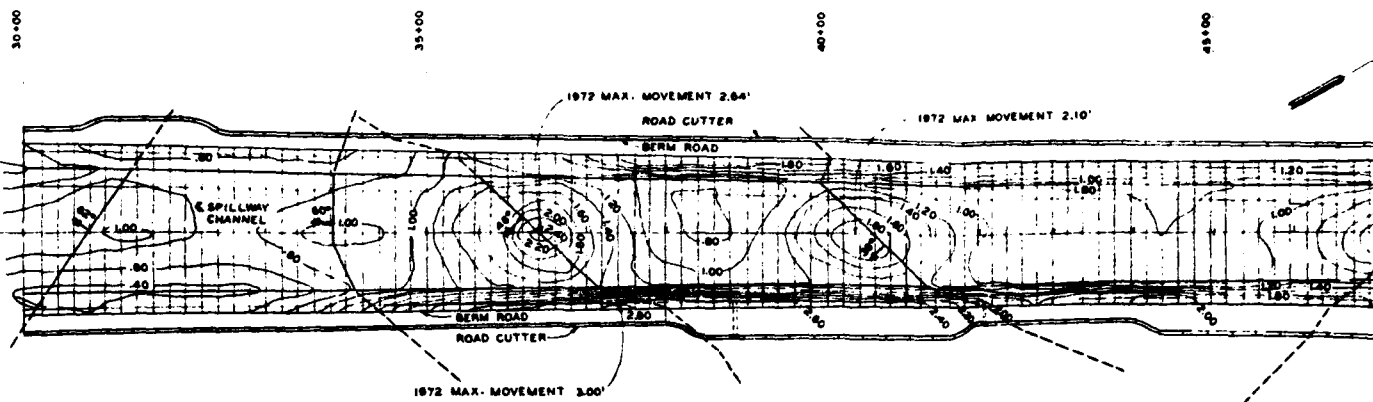
- NOTE:**
1. METHOD OF TRIANGULATION:
 - a. Chain accurately base line C-D.
 - b. Set transit on point C, back-sight to point D, then fore-sight to D-70; D-70; D-60; D-50 again back-sighting to point D, turn angles D-40; D-30; D-20, D-10, D-0, turning a set-
ting turn the corresponding angles on the right side of channel.
 - c. Set transit at point B, back-sight to point A, and fore-sight to C-80; C-70; C-60; C-50; C-40; C-30; C-20; C-10; C-0, turning the corresponding angles on the right side of channel from same setting.
 - d. Each angle must be double the average reading recorded.
 2. The great chain be always in change in distance (shortening) between both points on right & left side of the channel.



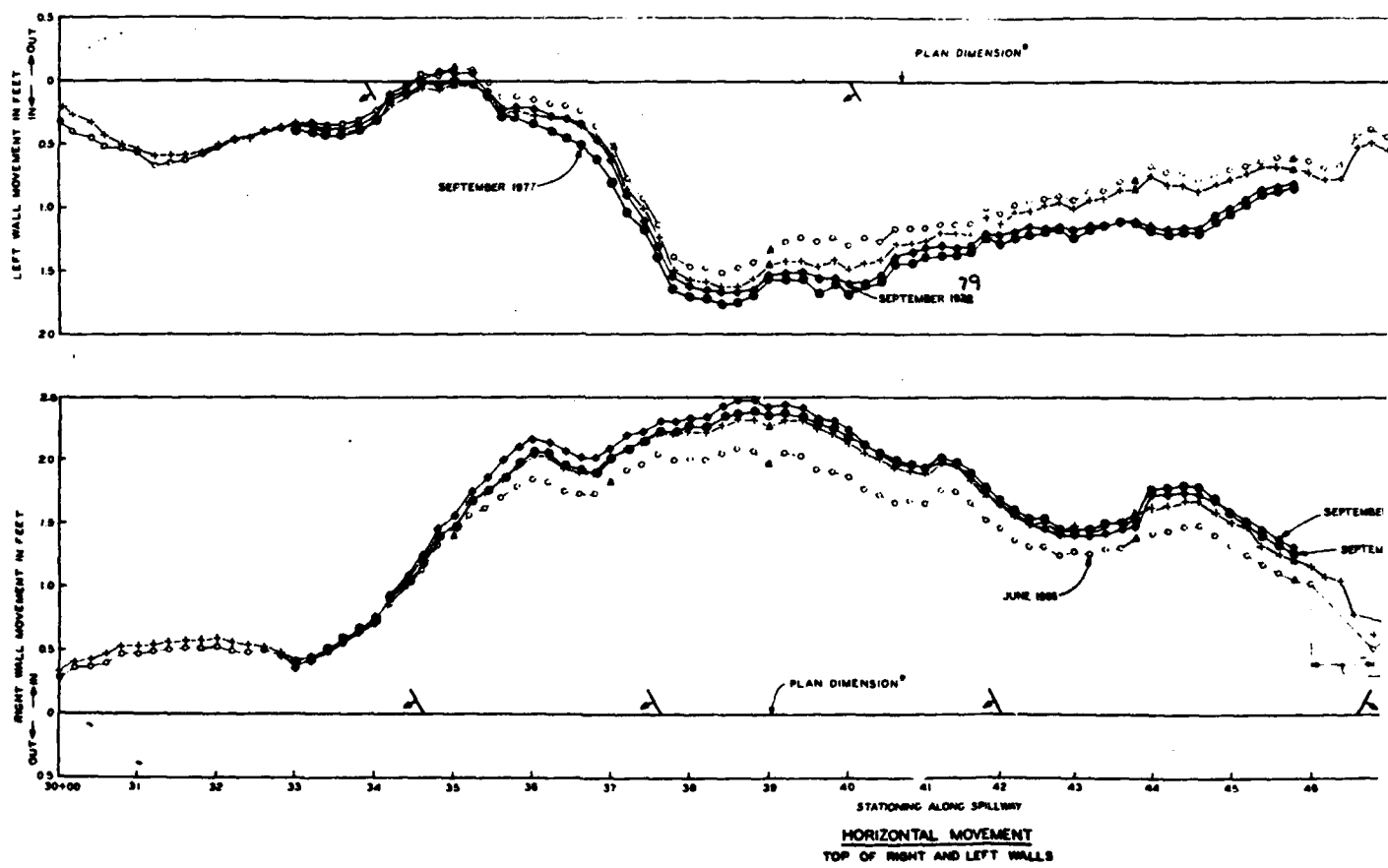
THIS DUBBING HAS BEEN REDUCED TO
THREE-FIFTHS THE ORIGINAL SCALE.



DIVISION U. S. ARMY ENGINEER DISTRICT, INDIANA OFFICE OF CHIEF ENGINEER INDIANAPOLIS, INDIANA		REGION FORT PECK LAKE, MONTANA SPILLWAY SLOPE EXCAVATION	
DESIGNED BY DRAWN BY CHECKED BY APPROVED BY DATE	DESIGNED BY DRAWN BY CHECKED BY APPROVED BY DATE	REGION FORT PECK LAKE, MONTANA SPILLWAY SLOPE EXCAVATION MONITORING MOVEMENT SURVEY PLAN DETAIL & THE MOVEMENT GRAPHIC SHEET 2	
DESIGNED BY DRAWN BY CHECKED BY APPROVED BY DATE		REGION FORT PECK LAKE, MONTANA SPILLWAY SLOPE EXCAVATION MONITORING MOVEMENT SURVEY PLAN DETAIL & THE MOVEMENT GRAPHIC SHEET 2	
DESIGNED BY DRAWN BY CHECKED BY APPROVED BY DATE		REGION FORT PECK LAKE, MONTANA SPILLWAY SLOPE EXCAVATION MONITORING MOVEMENT SURVEY PLAN DETAIL & THE MOVEMENT GRAPHIC SHEET 2	

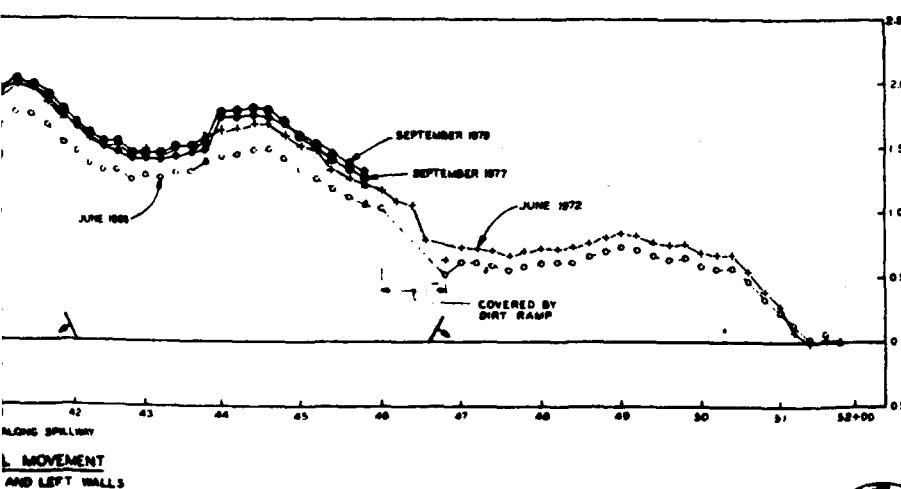
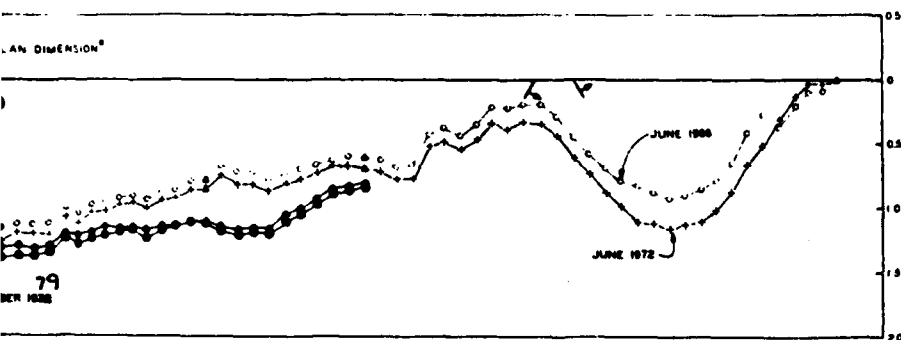
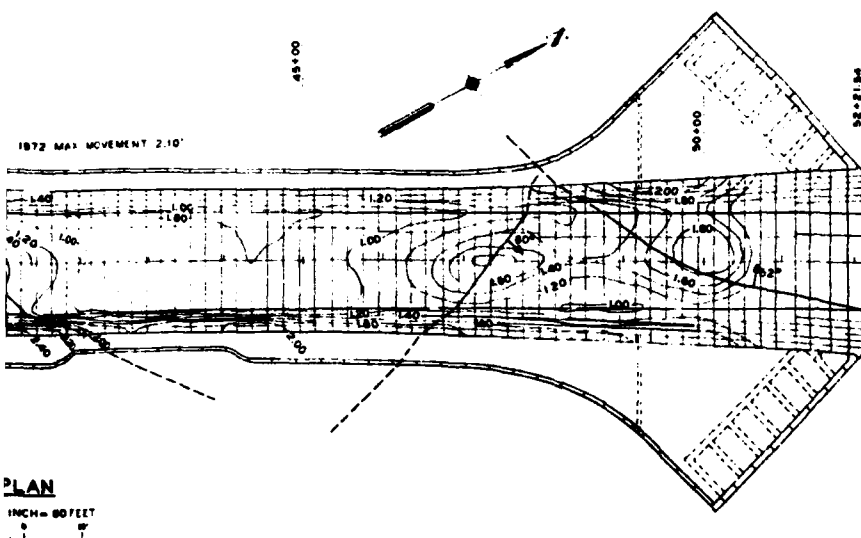


PLAN
SCALE 1 INCH = 80 FEET



A US Movement Plan of A River, Reservoir, or Lake
Copy and to include Every Movement and/or Modification

MOVEMENT NO.	
DATE	
LOCATION	
DATE	



LEGEND:

- Contours show feet of vertical displacement (1966).
- Fault showing direction and amount of dip.
- Spillway constructed during 1936 & 1937.
- △ By triangulation survey.
- Survey June 1966
- Survey June 1972
- Survey Sept. 1977
- ◆ Survey Sept. 1979

THIS DRAWING HAS BEEN REDUCED TO THREE-FIFTHS THE ORIGINAL SCALE.

DATE	DESCRIPTION	SCALE	APPROVED
REVISIONS			
U. S. ARMY ENGINEER DISTRICT, OMAHA GROUP OF ENGINEERS OMAHA, NEBRASKA			
DESIGNED BY: U.S.A.		MISSOURI RIVER	
CHECKED BY: U.S.A.		FORT PECK LAKE, MONTANA	
DRAWN BY: C.E.J.		SPILLWAY SLOPE EXCAVATION	
APPROVED BY: [Signature]		HORIZONTAL MOVEMENT-TOP OF WALL	
DATE: SEP 1979		STA. 30+00 TO CUT-OFF WALL	
[Signature]		[Signature]	
[Signature]		[Signature]	
[Signature]		[Signature]	



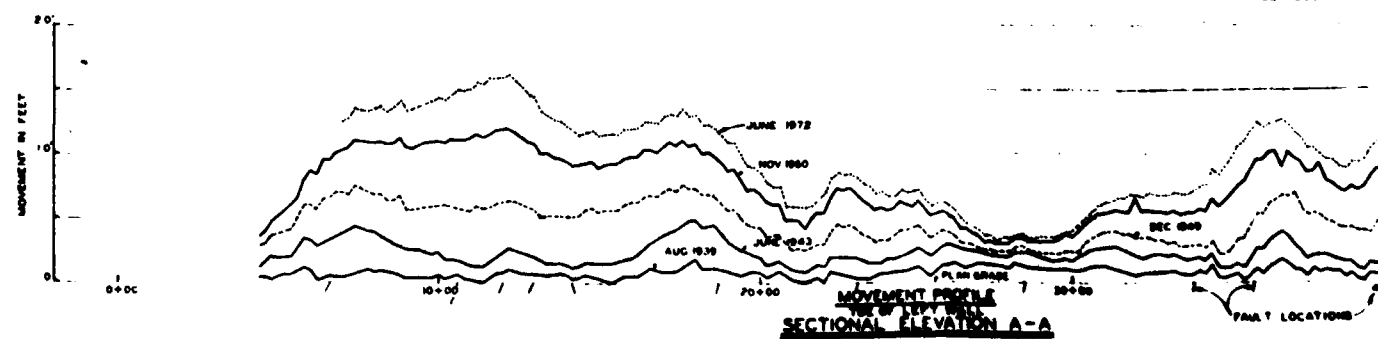
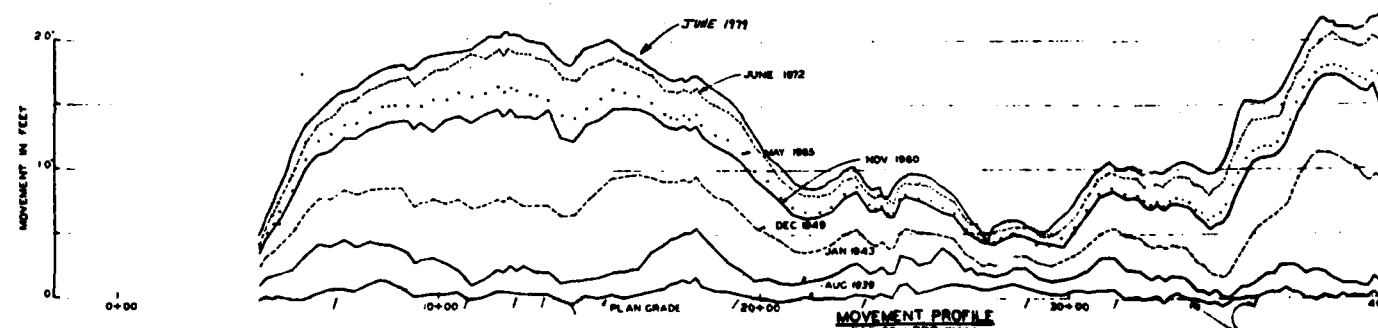
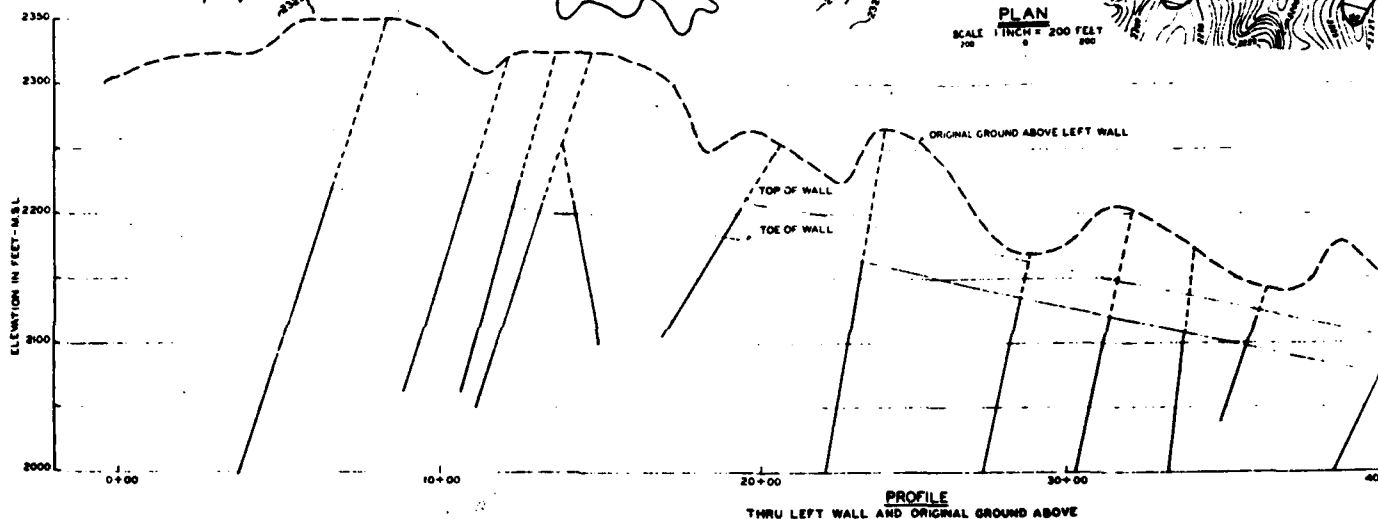
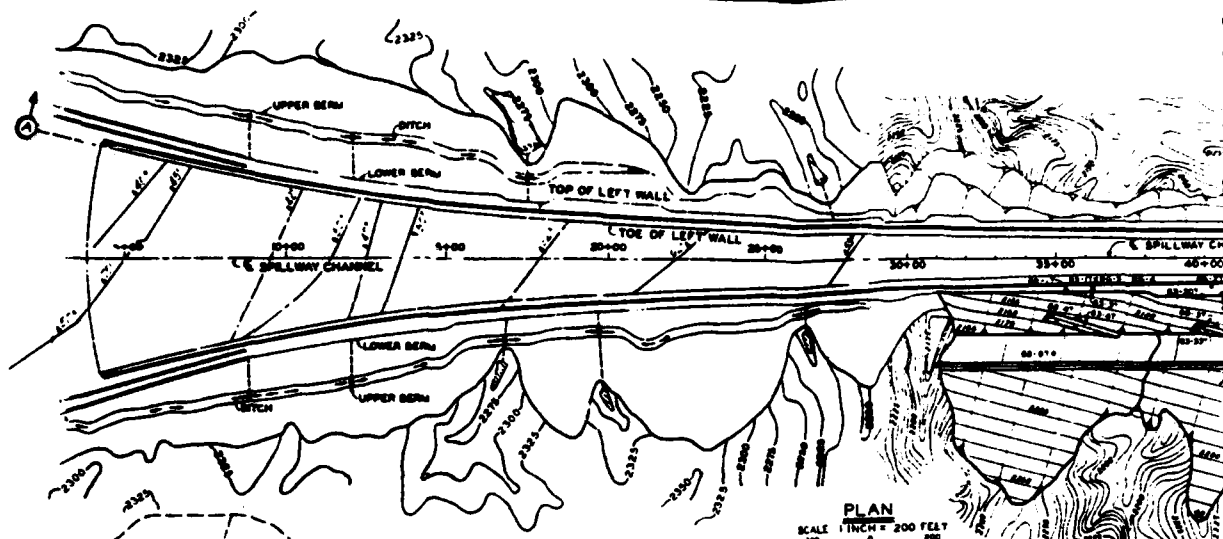
THIS PLAN ACCOMPANIES CONTRACT NO. DA-36-556-100
MODIFICATION NO.

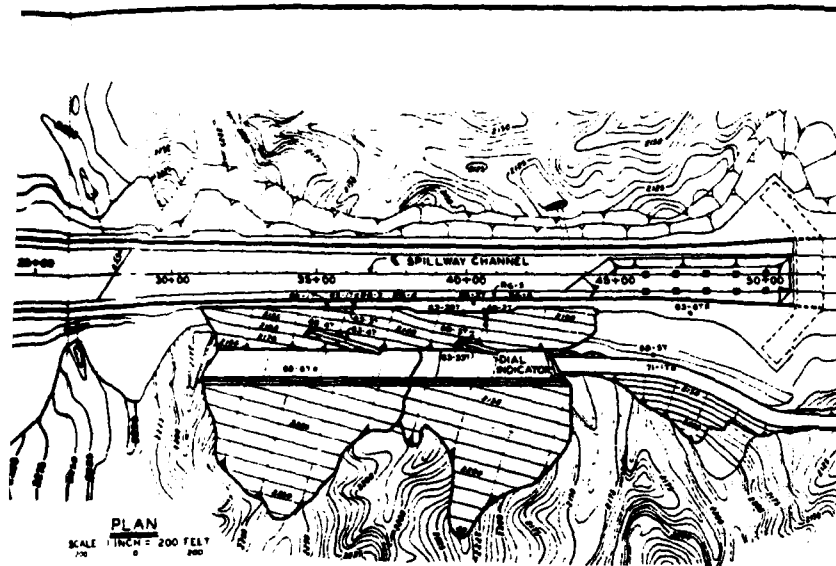
CONSTRUCTION FOUNDATION REPORT

2 PLATE 124

A 100 Micrometer Map of A Paper Reproducible Material
Copy from the Master before every Amendment and/or Modification

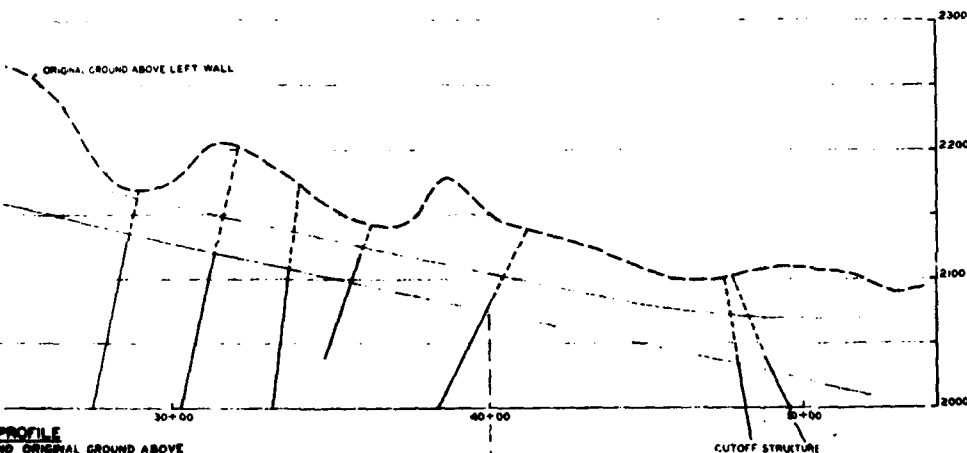
ADDENDUM NO.	
DATE	
MODIFICATION	
DATE	





LEGEND:

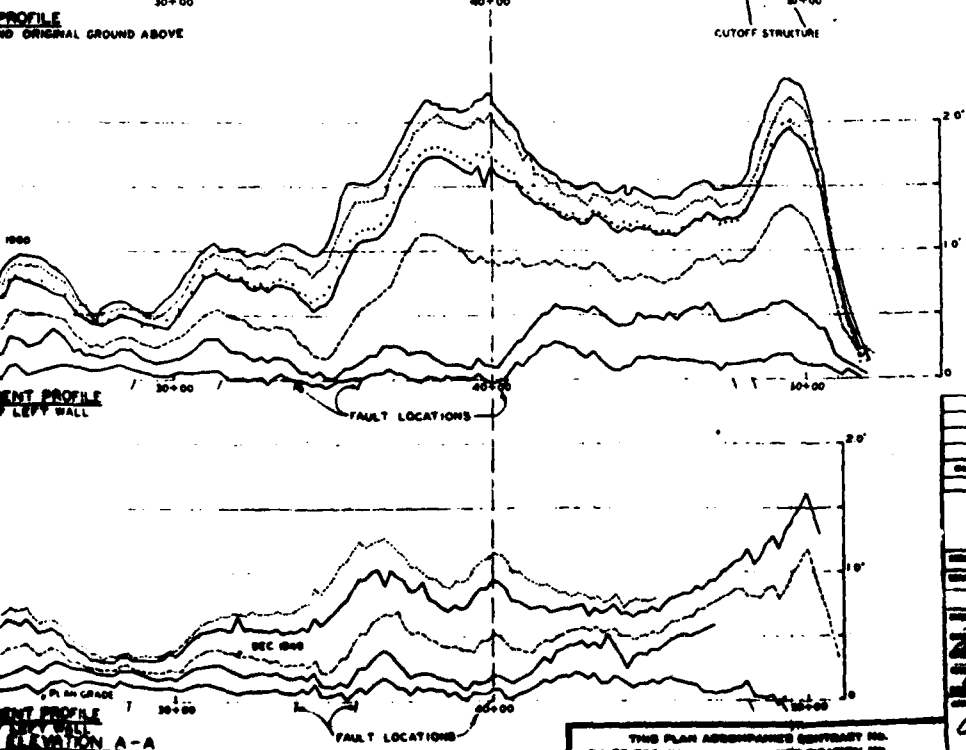
- TILTMETER
- REBOUND GAGES
- SETTLEMENT GAGES



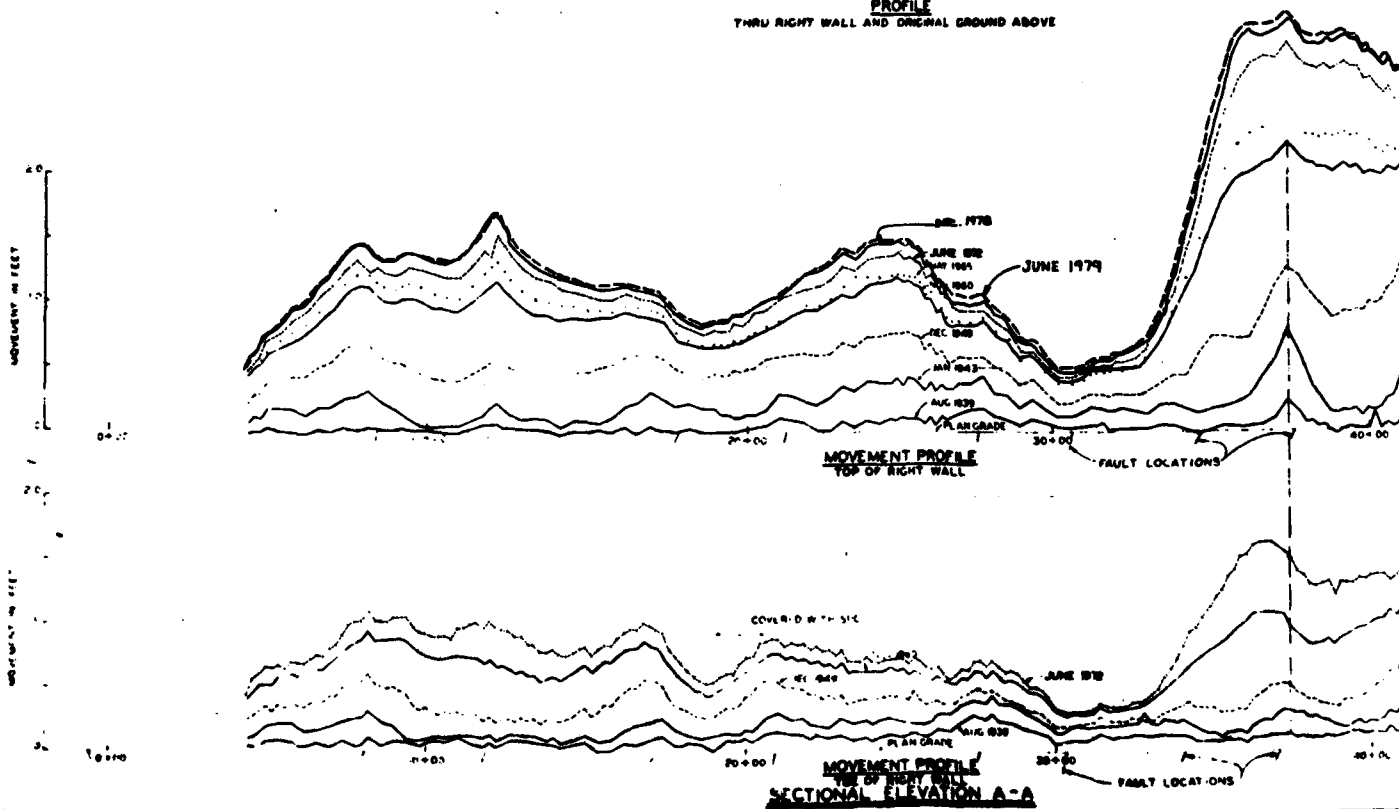
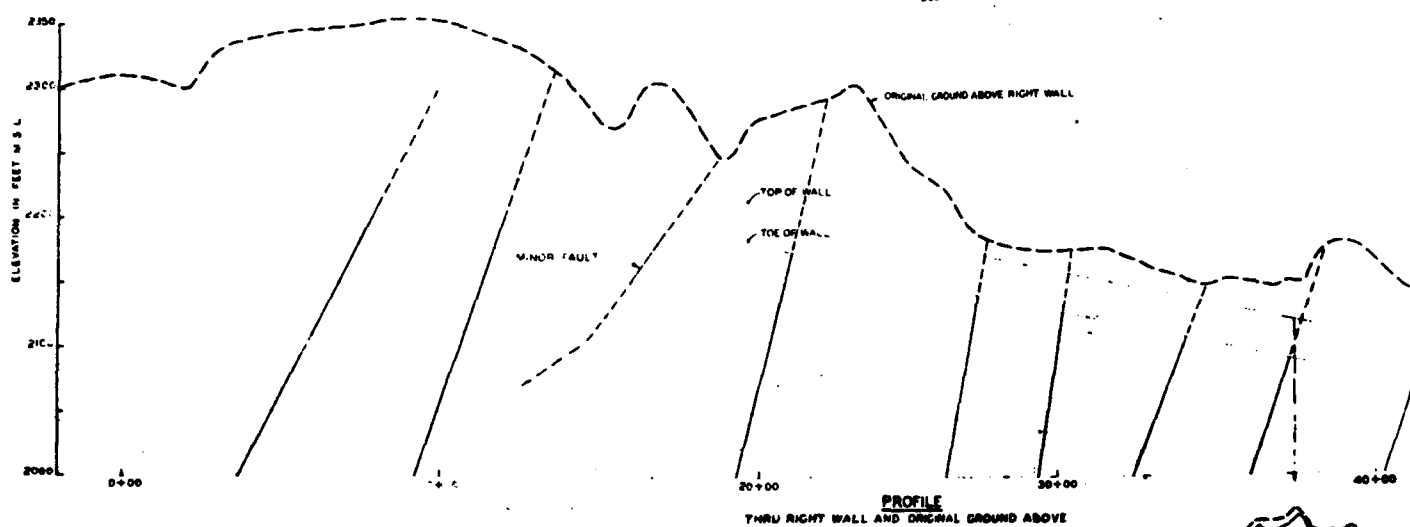
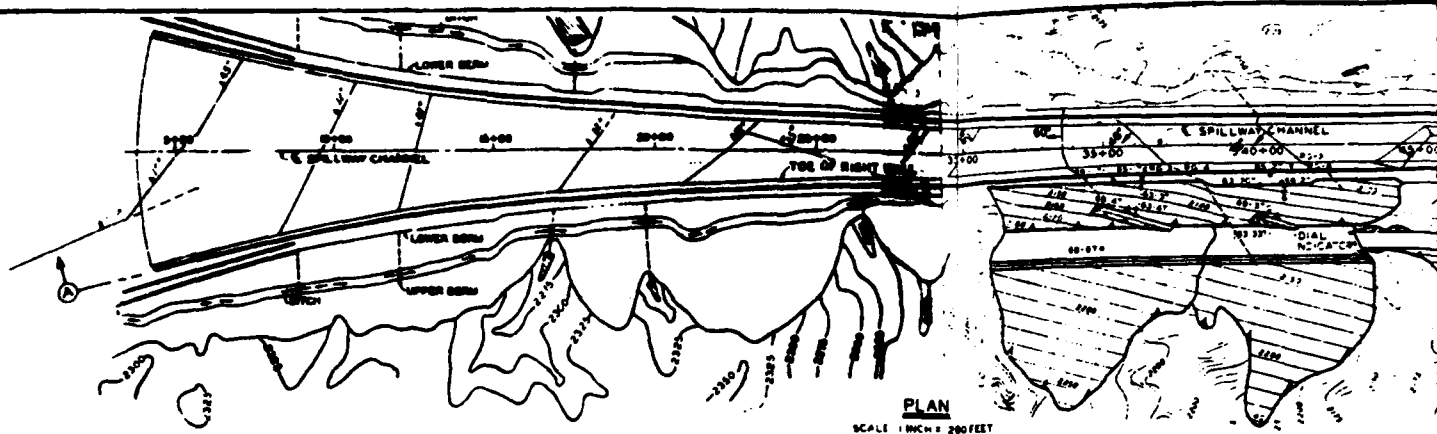
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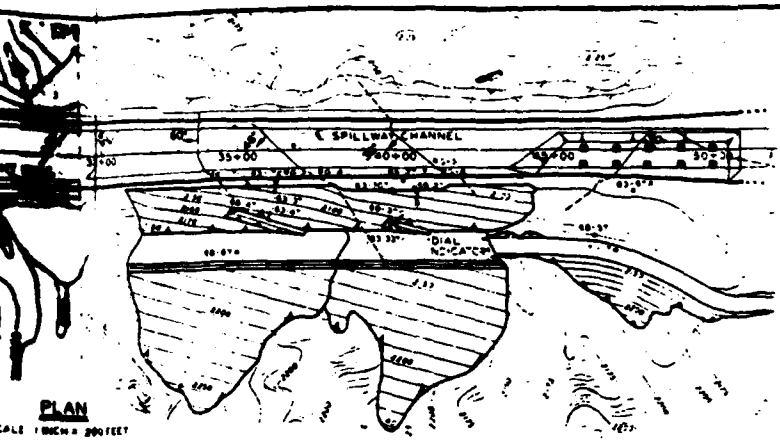
1. Faults are shown at correct location at toe of wall profile and apparent dip drawn up and down from this line.
2. West (left) wall and cantilever slab placed from Sta. 4+40 to Sta. 51+26 during 1937 construction season.

THIS DRAWING HAS BEEN REDUCED TO THREE-FOURTHS THE ORIGINAL SCALE.

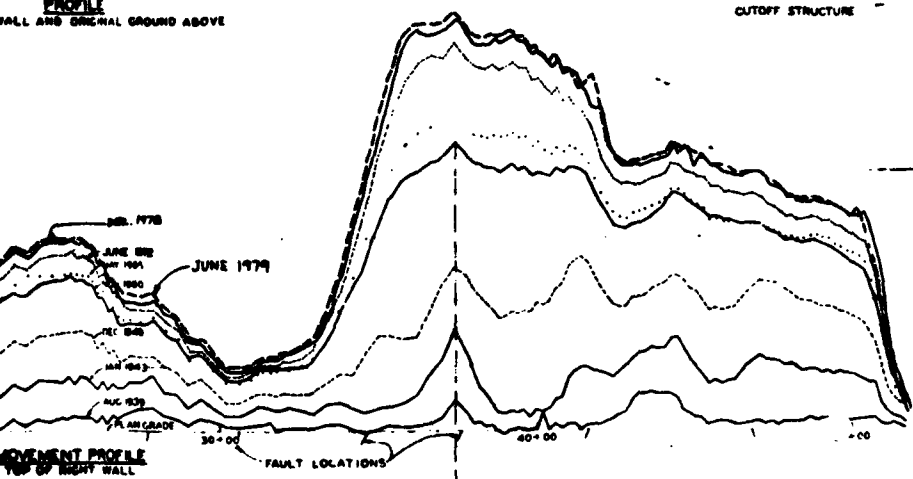
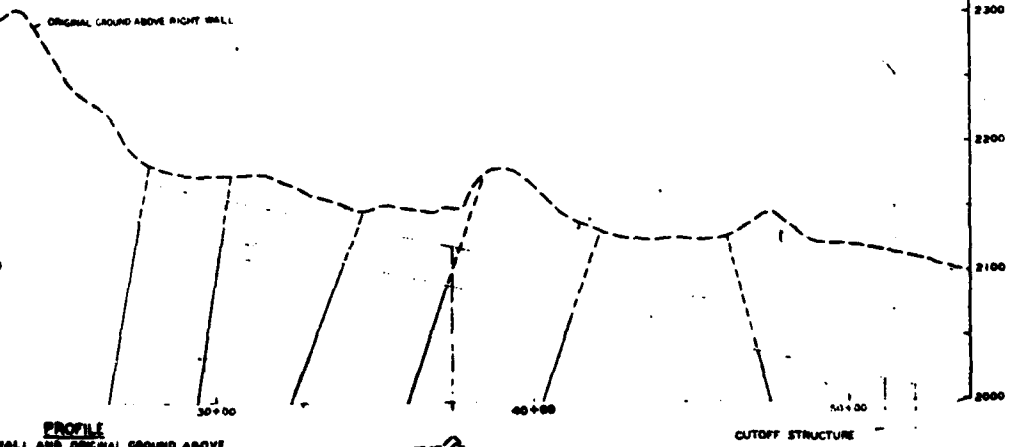


DESIGNED BY: S.E.A.		CHECKED BY: S.E.A.	
DRAWN BY: S.E.A.		CHECKED BY: S.E.A.	
U. S. ARMY ENGINEER DISTRICT, OMAHA GROUP OF ENGINEERS OMAHA, NEBRASKA			
MISSOURI RIVER FORT PECK LAKE, MONTANA SPILLWAY SLOPE EXCAVATION LEFT WALL VERTICAL MOVEMENT VS. ORIGINAL GROUND AND FOUNDATION FAULTING			
DATE: SEP 1937	BY: S.E.A.	DATE: SEP 1937	BY: S.E.A.
APPROVED BY: <i>Alfred H. Brinkley</i>		APPROVED BY: <i>Alfred H. Brinkley</i>	
THIS PLAN ACCOMPANIES CERTIFICATE NO. 5A-25-505-49		REVISION NO. 1	



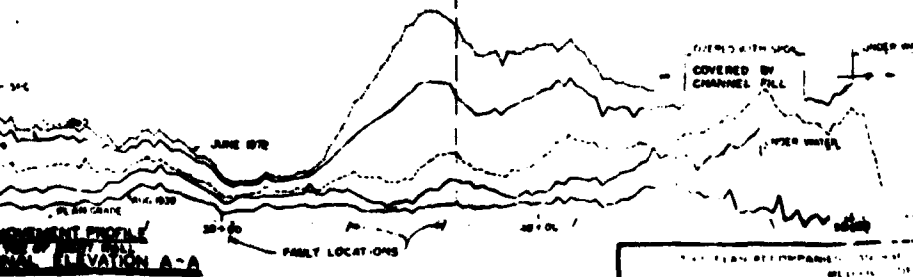


LEGEND:
 ○ TILT METER
 ▲ RESOUND GAGE
 ■ SETTLEMENT GAGE



One tribrach wall on centerline slab placed from Sta. 40+00 to Sta. 45+00 in 1958 construction. The wall was placed on Sta. 45+00. It placed upon 1957 construction subgrade.

THIS DRAWING HAS BEEN REDUCED TO THREE-FOURTHS THE ORIGINAL SCALE.

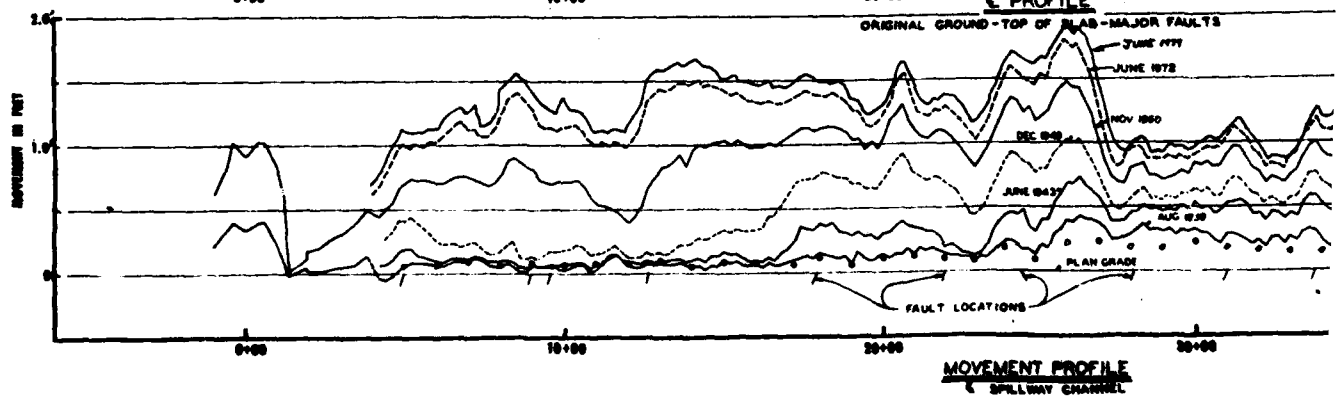
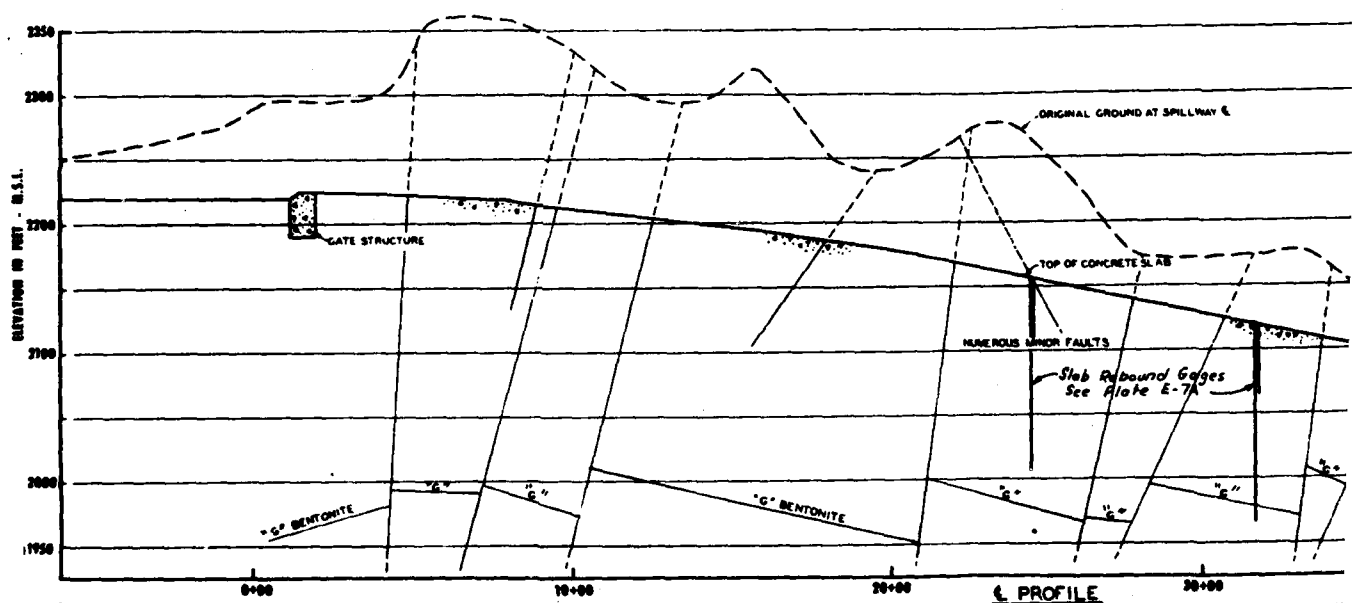
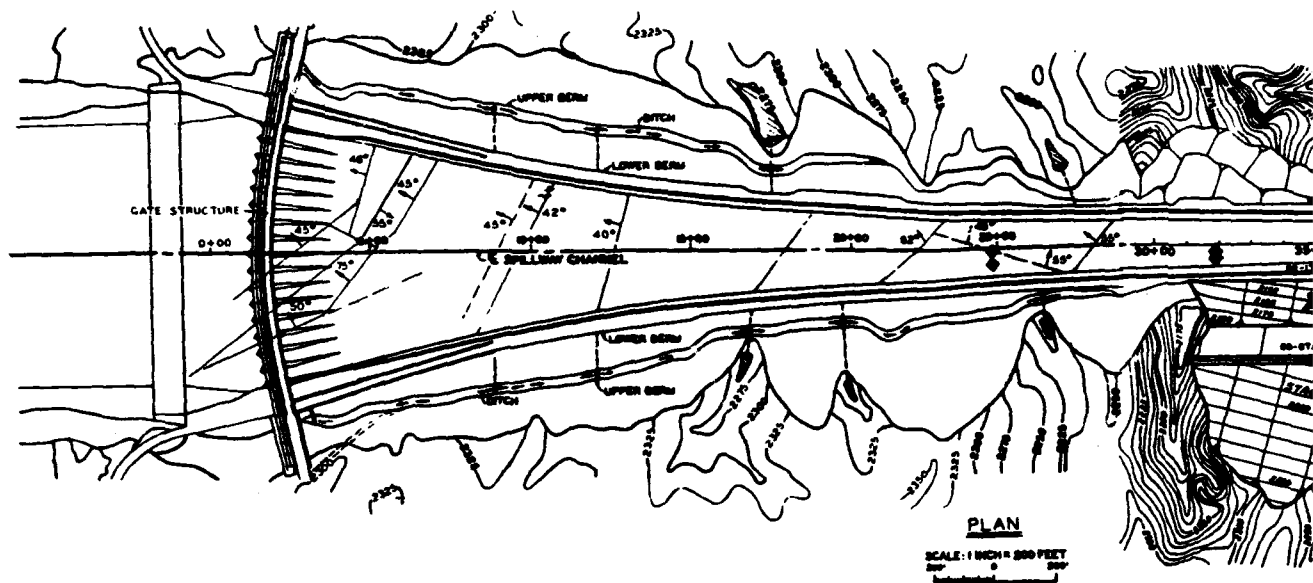


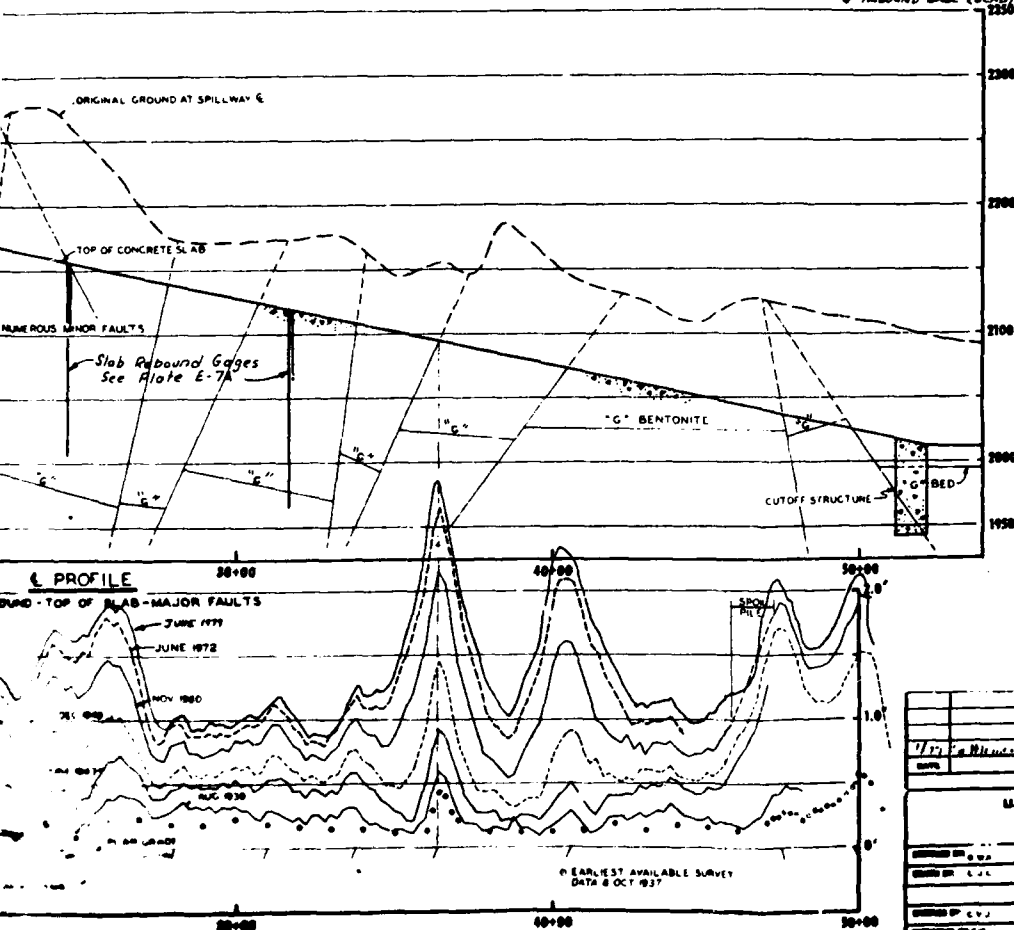
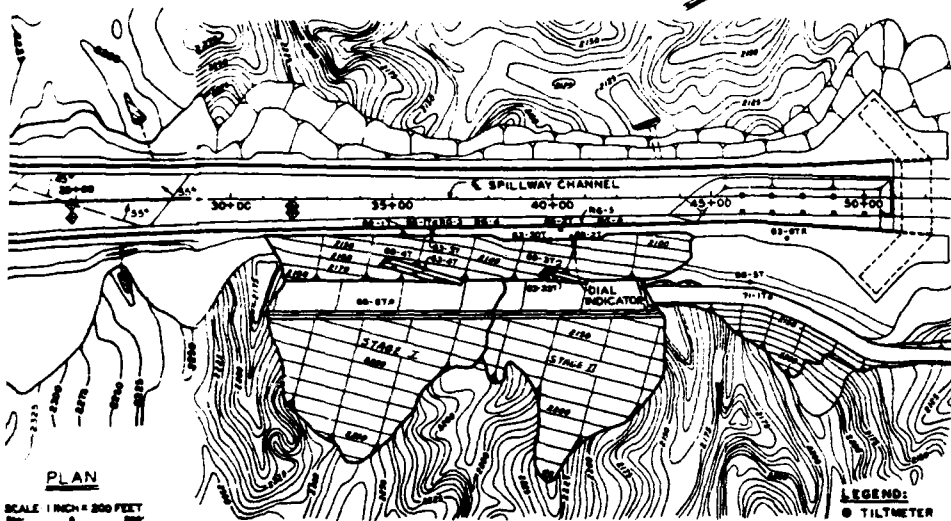
U. S. ARMY ENGINEER DISTRICT, OMAHA
 CHIEF OF ENGINEERS
 OMAHA, NEBRASKA

FORT PECK LAKE, MONTANA
SPILLWAY SLOPE EXCAVATION
RIGHT WALL VERTICAL MOVEMENT VS.
ORIGINAL GROUND AND FOUNDATION RELATIONS

Author: *Alfred D. Buckley*
 Date: *1958*
 Scale: *1/4" = 10'*
 Sheet: *126*

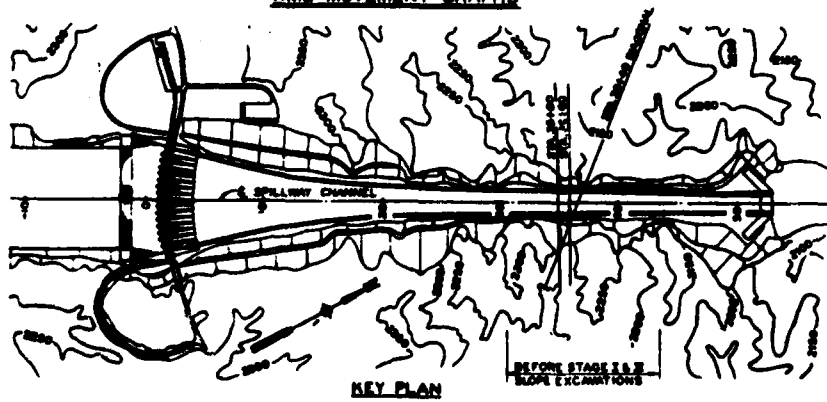
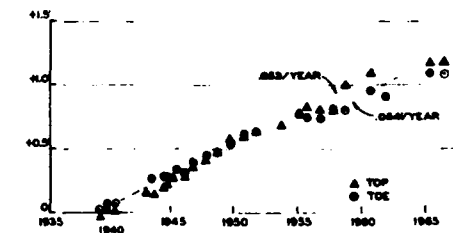
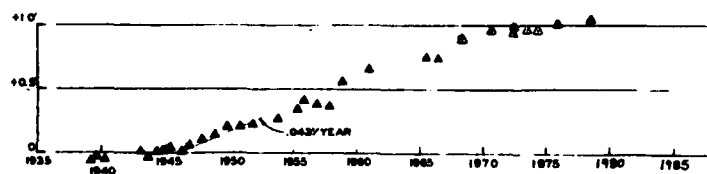
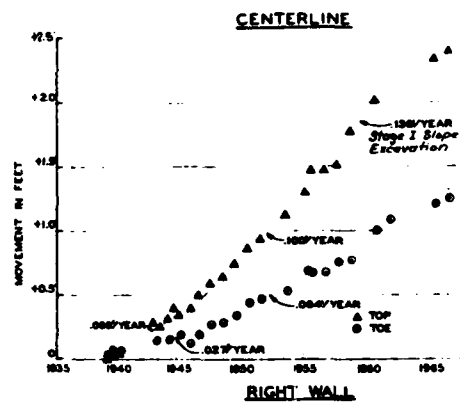
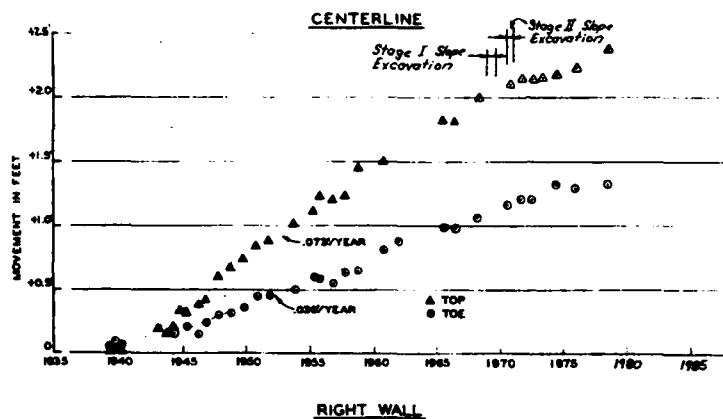
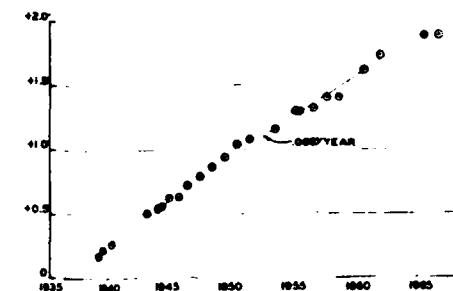
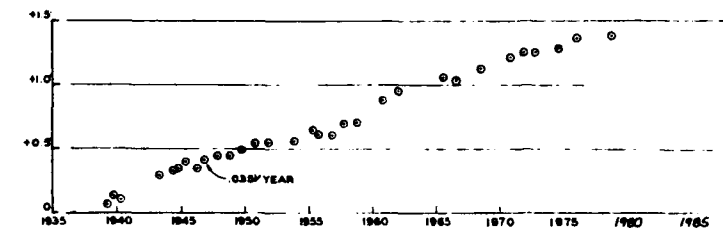
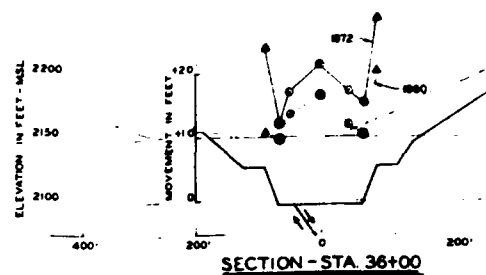
2

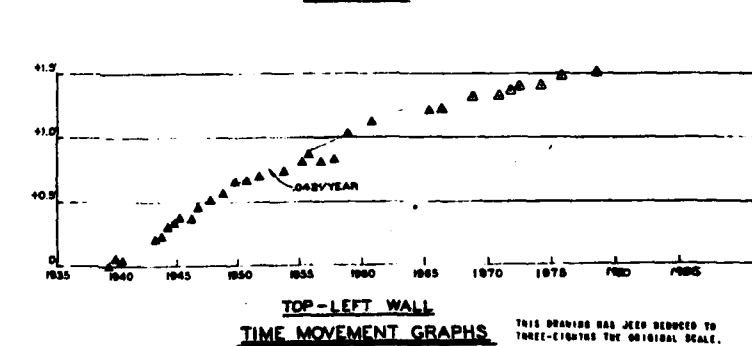
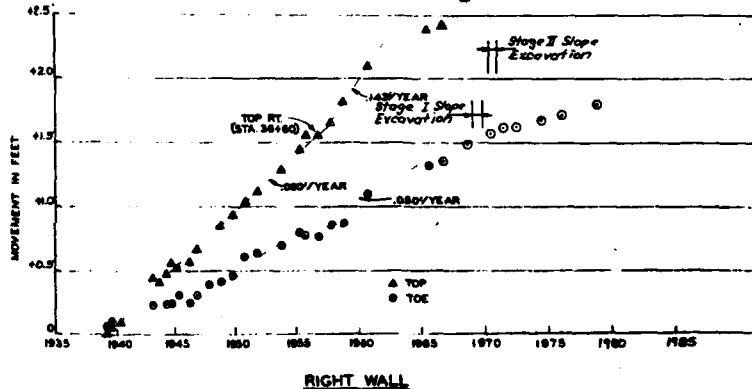
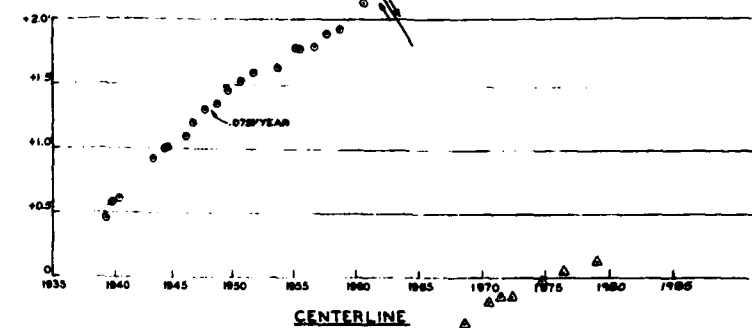
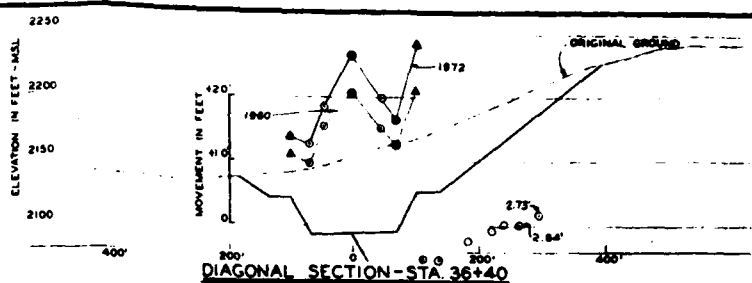
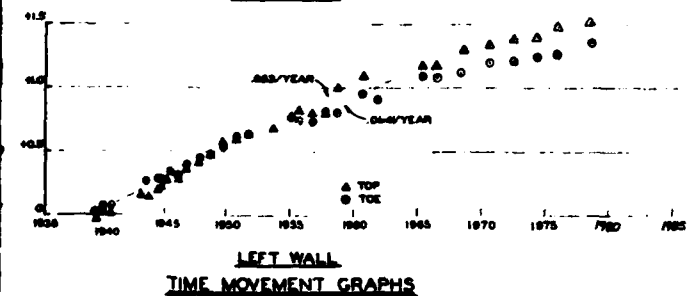
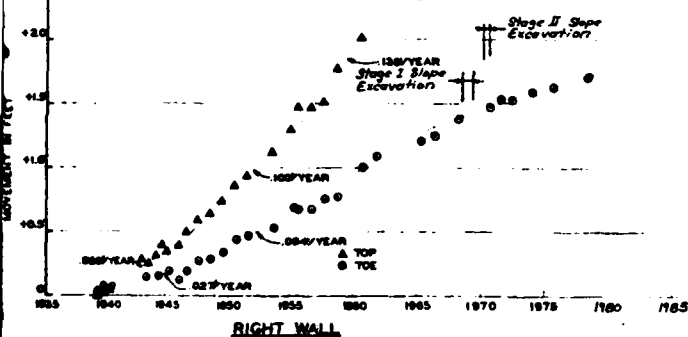
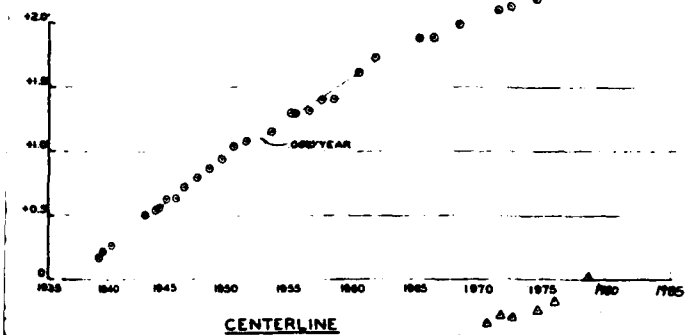
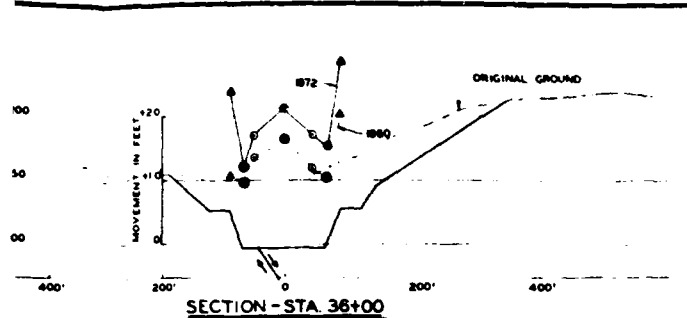




THIS DRAWING HAS BEEN REDUCED TO
THREE-FOURTHS THE ORIGINAL SCALE.

U. S. ARMY ENGINEER DISTRICT, SHAWA	
ENGINEER DISTRICT, SHAWA, MONTANA	
DESIGN DIVISION	
FORT PECK LAKE, MONTANA	
SPILLWAY SLOPE EXCAVATION	
CENTERLINE VERTICAL MOVEMENT VS	
ORIGINAL GROUND & FOUNDATION FAULTING	
DESIGNED BY: E. J. J.	DATE: 1971
CHECKED BY: E. J. J.	DATE: 1971
APPROVED BY: <i>Alfred L. Brubaker</i>	DATE: SEP 1971
DRAWN BY: <i>Alfred L. Brubaker</i>	
DATE: SEP 1971	





THIS DRAWING HAS BEEN REDUCED TO THREE-FOURTHS THE ORIGINAL SCALE.



THIS PLAN ACCOMPANIES CONTRACT NO. DA-36-244-100 MODIFICATION NO.

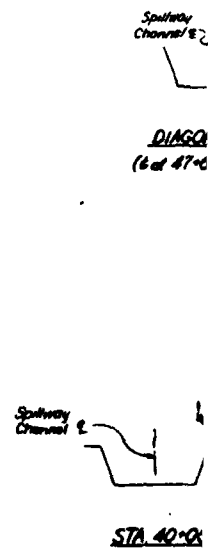
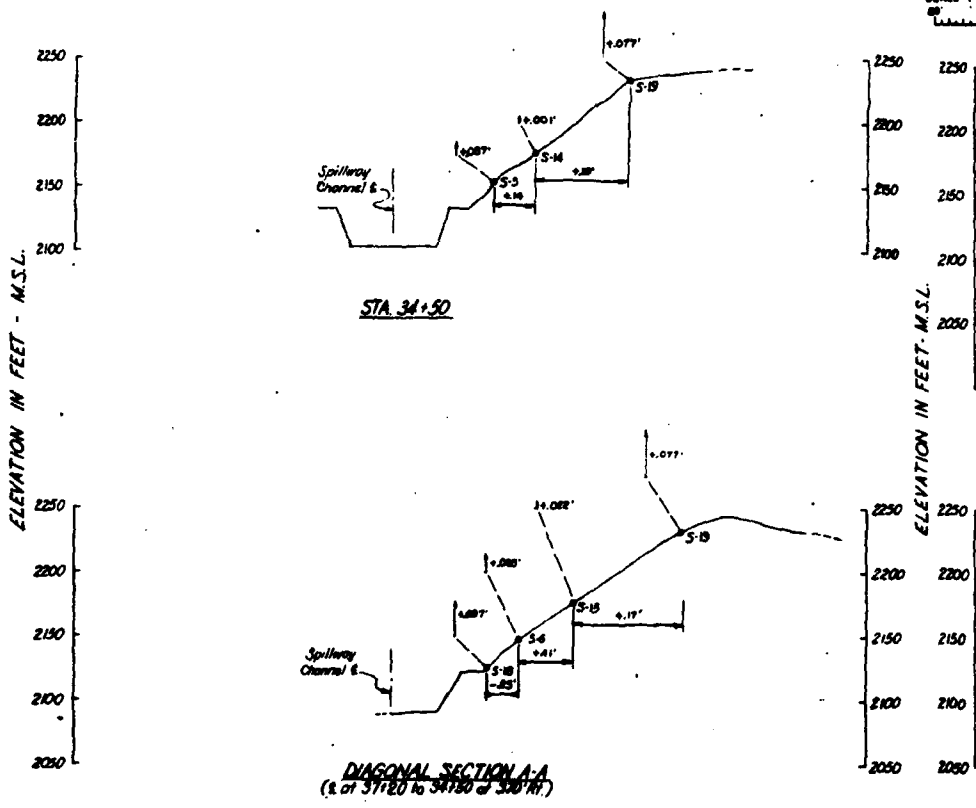
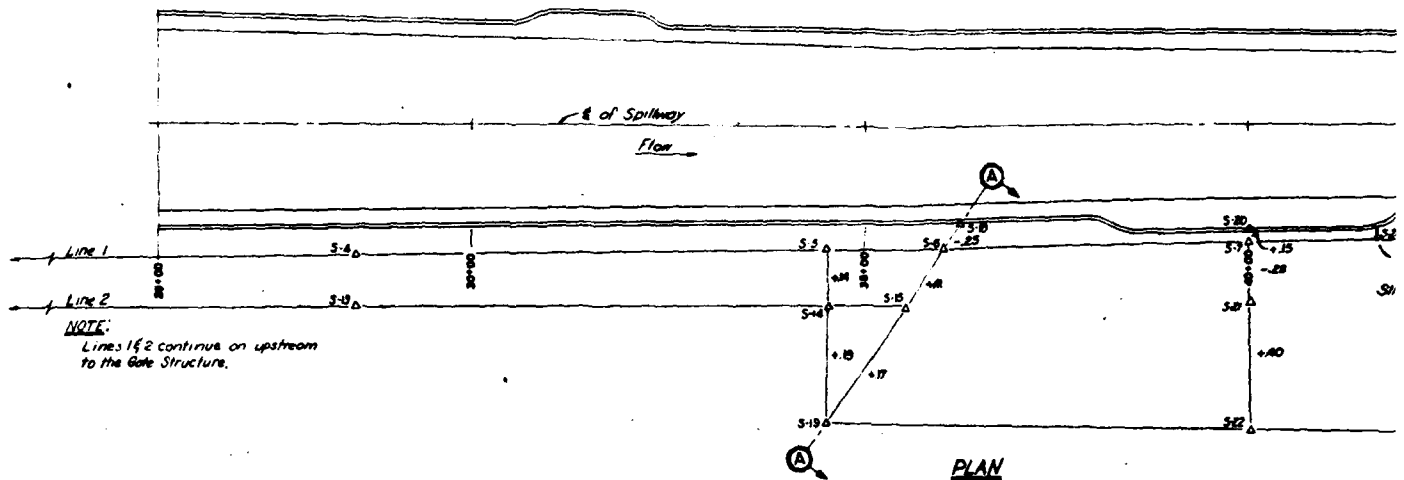
DATE		DESIGNATION		REVISION	APPROVED
REVISIONS					
U. S. ARMY ENGINEER DISTRICT, OMAHA DIVISION OF ENGINEERS OMAHA, NEBRASKA					
MISSOURI RIVER					
FORT PECK LAKE, MONTANA					
SPILLWAY SLOPE EXCAVATION					
CHANNEL SECTIONS - STA. 36+00, 36+00.5, 36+40					
VERTICAL-TIME MOVEMENT RECORDS					
DESIGNED BY C. J. S. S.	CHECKED BY C. J. S. S.	APPROVED BY <i>Arthur H. Brinkley</i>		DATE SEP 1980	BY [Signature]
DRAWN BY [Signature]		CHECKED BY [Signature]		DATE SEP 1980	BY [Signature]

CONSTRUCTION FOUNDATION REPORT

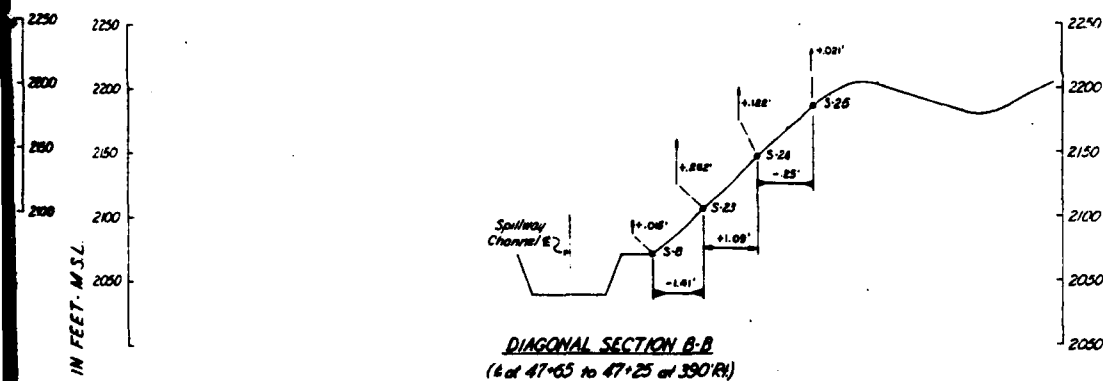
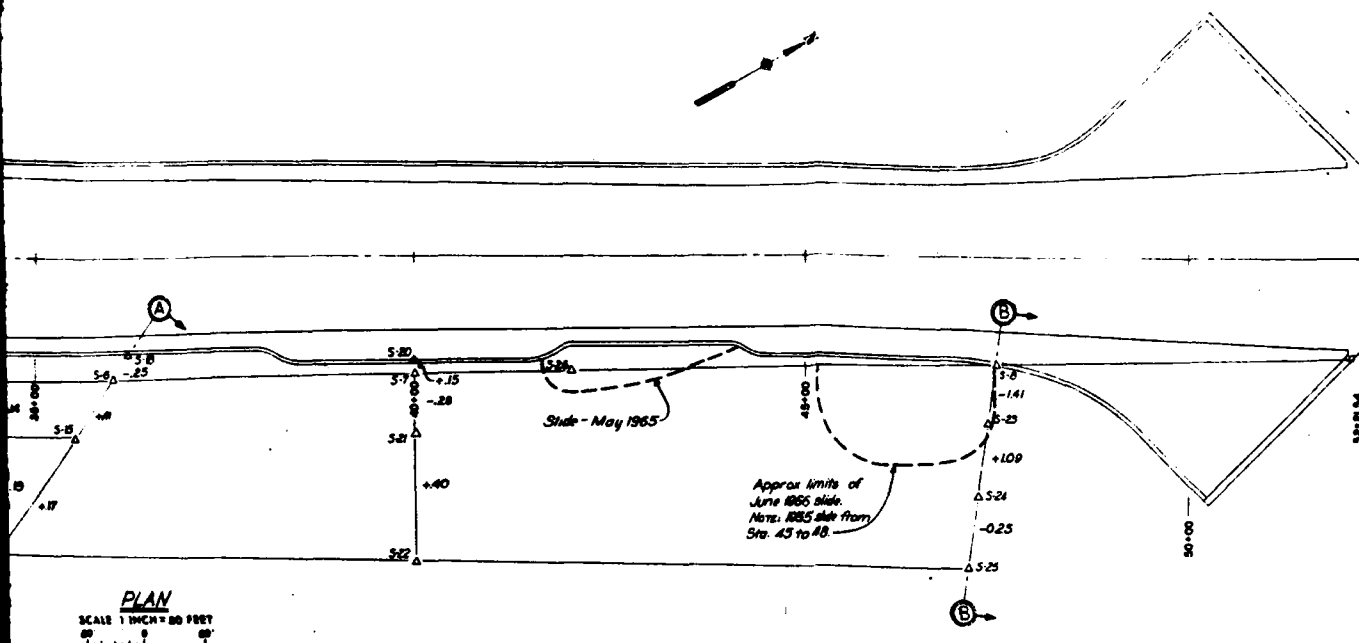
PLATE 128

2

CORPS OF ENGINEERS

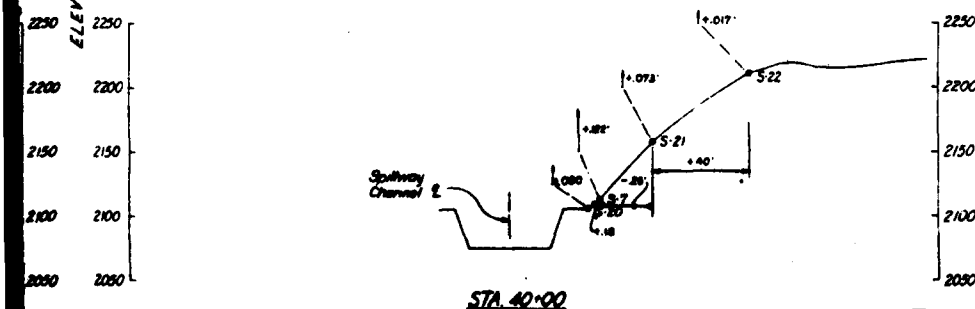


THIS DRAWING HAS BEEN DESIGNED TO
THREE-SIXTHS THE ORIGINAL SCALE.



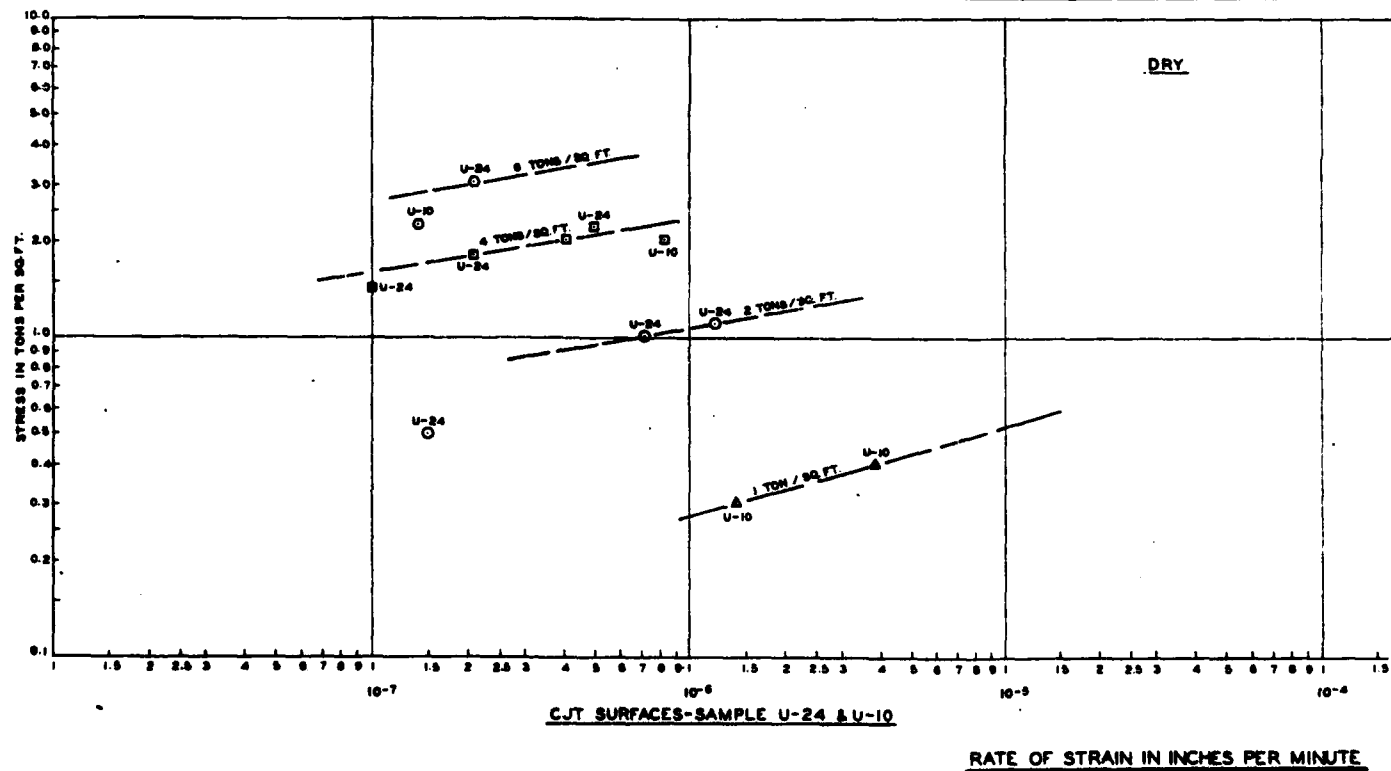
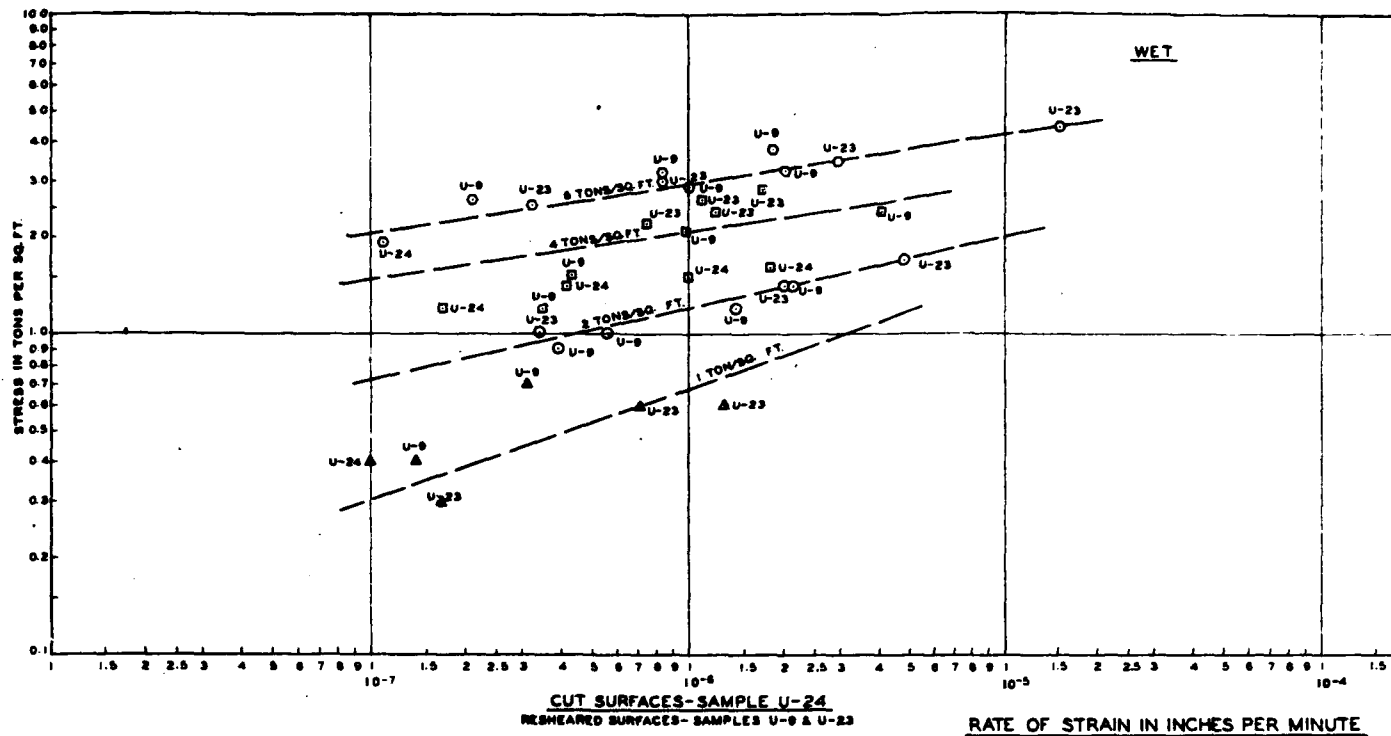
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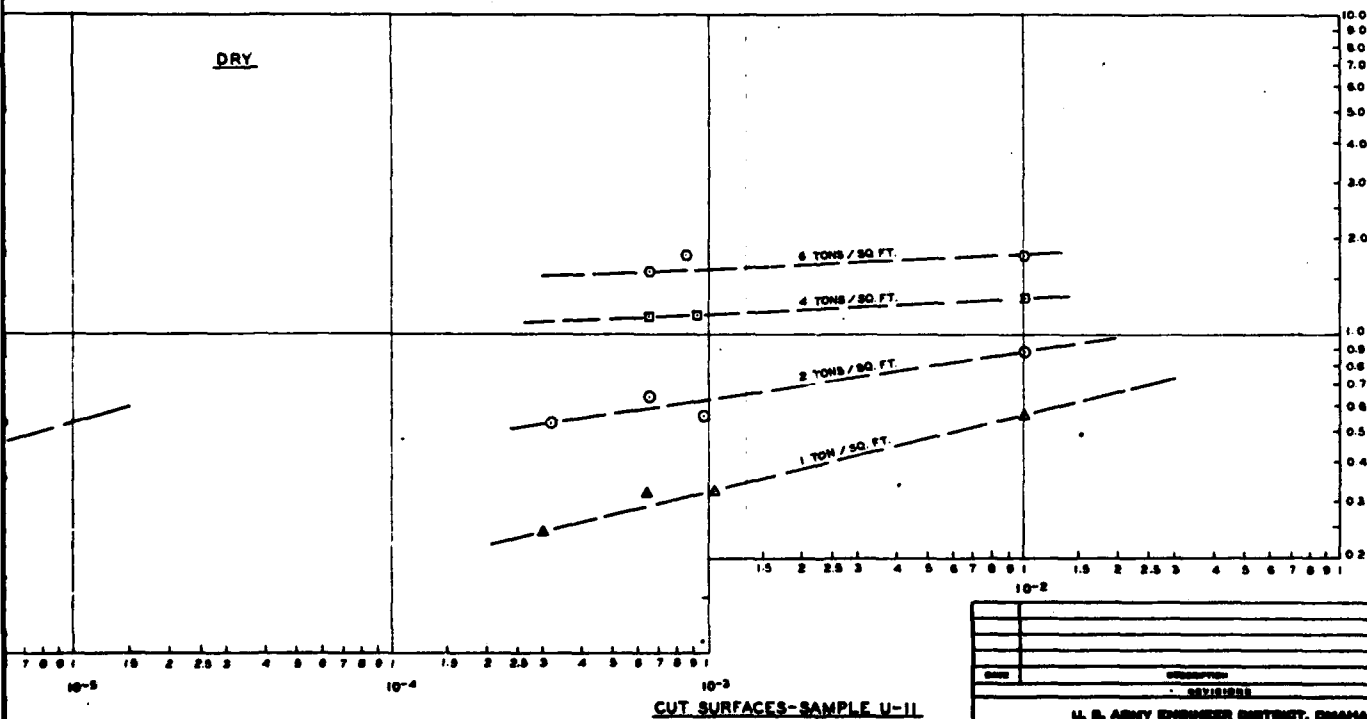
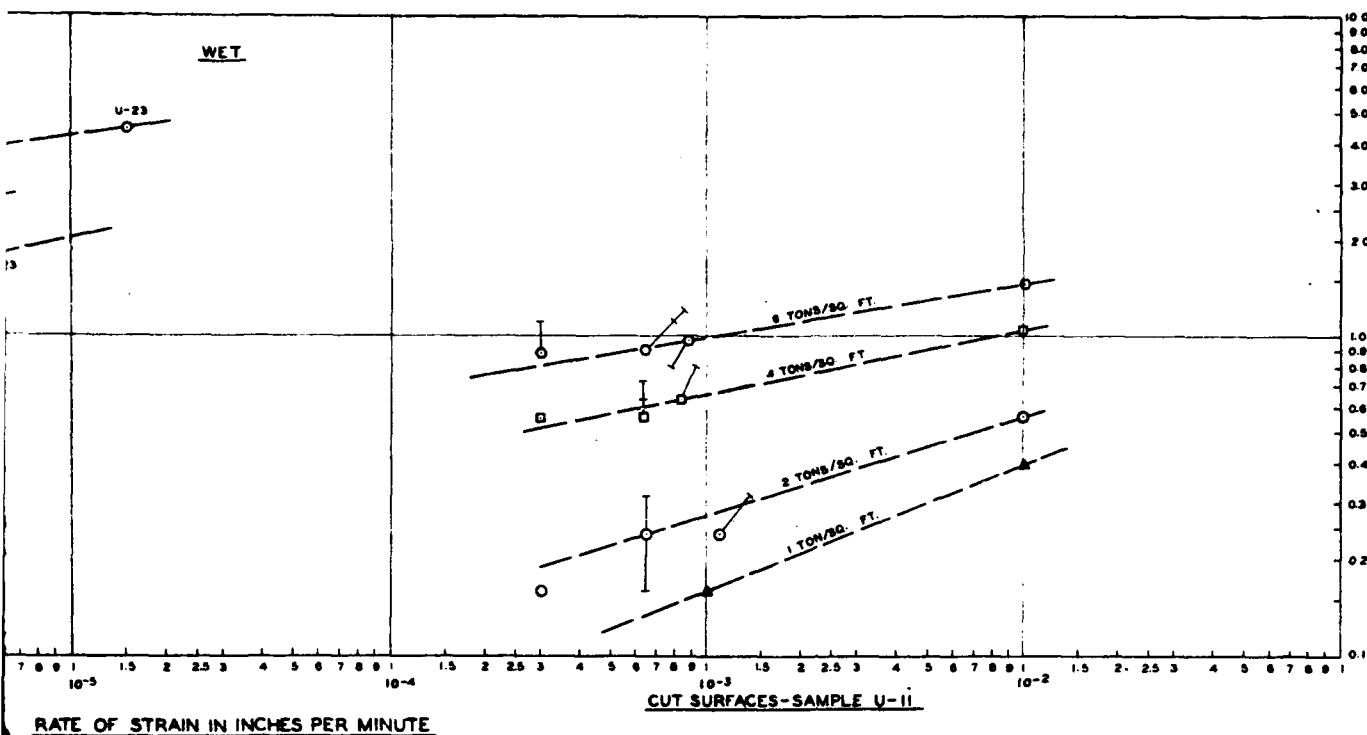
1. Slope movement shown on sections is from Initial Mar. 1963 to June 1966.
2. +.19 indicates 0.19 foot elongation of horizontal distance or gain in elevation of point. Minus (-) indicates shortening of horizontal distance or settlement of point.



U. S. ARMY ENGINEER DISTRICT, DHAMA CORPS OF ENGINEERS DHAMA, NEBRASKA	
DESIGNED BY: J. J. J.	REVISIONS
DRAWN BY: J. J. J.	DATE
CHECKED BY: J. J. J.	APPROVED
MISSOURI RIVER FORT PECK DAM AND RESERVOIR SPILLWAY REHABILITATION SLOPE MOVEMENT OBSERVATIONS PLAN AND SECTIONS	
APPROVED BY: J. J. J.	DATE: SEPT 1966
DESIGNED BY: J. J. J.	DATE: SEPT 1966
CHECKED BY: J. J. J.	DATE: SEPT 1966
DRAWN BY: J. J. J.	DATE: SEPT 1966

2





LEGEND:

- △ 1 TON
- 2 TONS
- 4 TONS
- 8 TONS

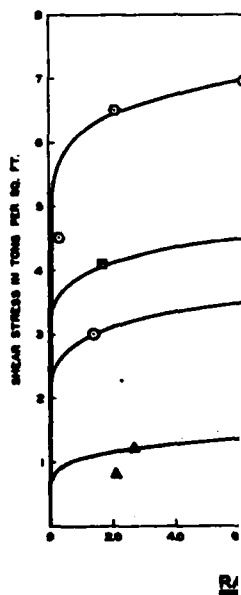
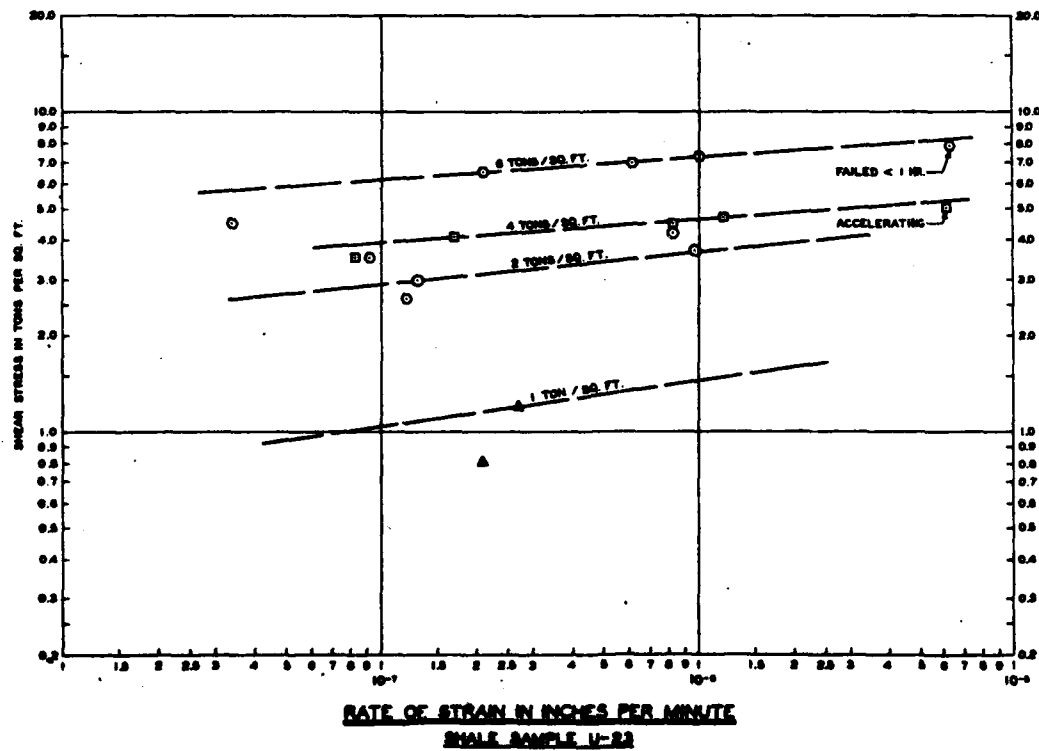
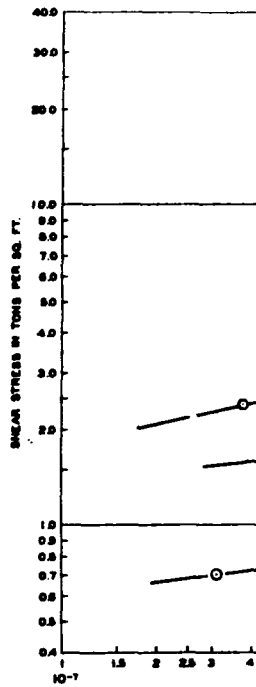
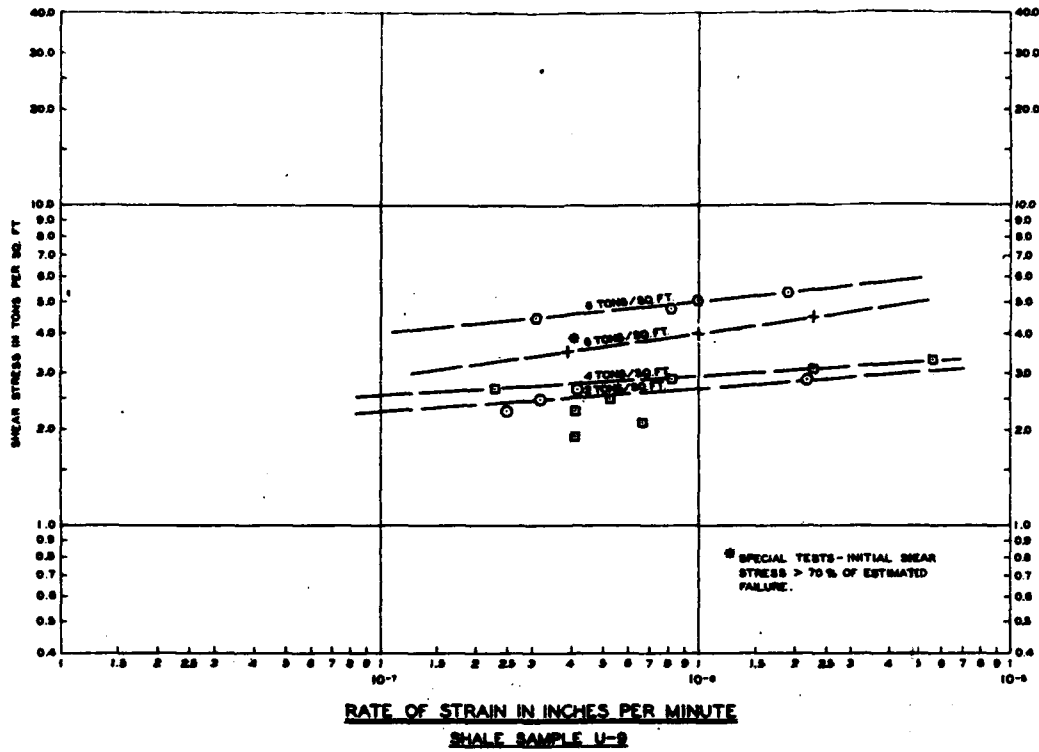


THIS GRAPH HAS BEEN REDUCED TO
THREE-FIFTHS THE ORIGINAL SCALE.

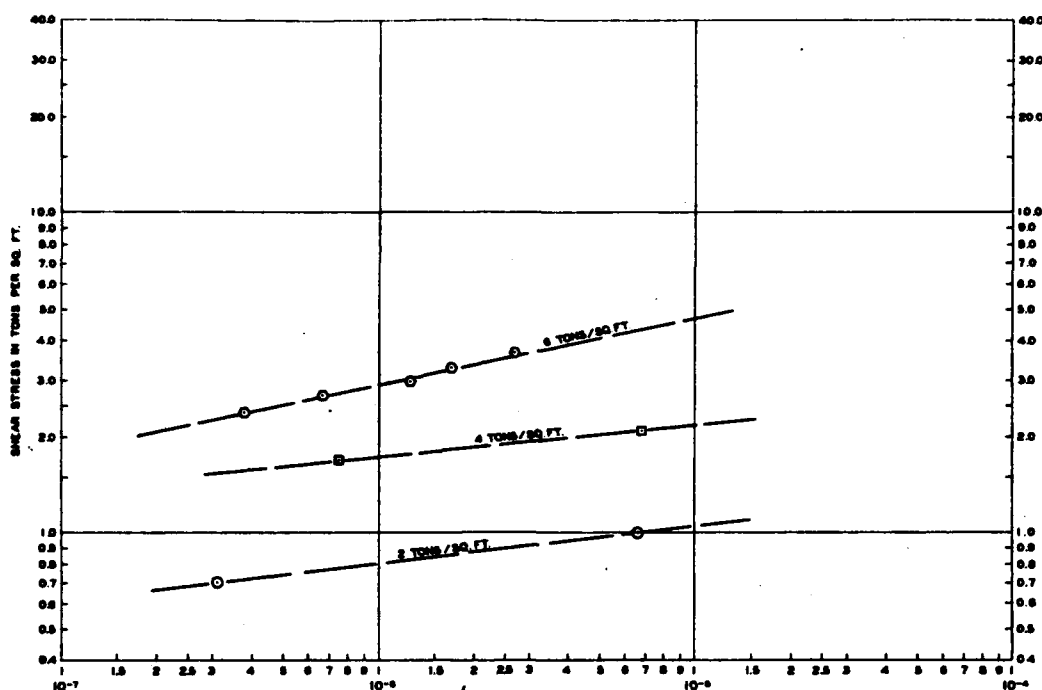
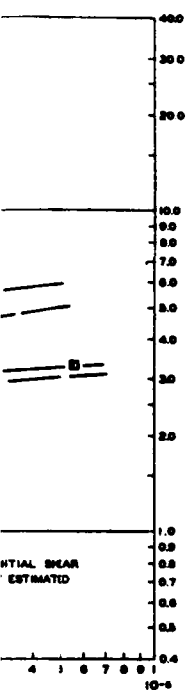
THIS PLAN ACCOMPANIES CERTAINITY NO.
DA-25-555-100

U. S. ARMY ENGINEER DISTRICT, OMAHA GROUP OF ENGINEERS OMAHA, NEBRASKA	
MISSOURI RIVER FORT PECK DAM AND RESERVOIR SPILLWAY REHABILITATION RATE OF STRAIN VS. STRESS SHALE FRICTION TESTS	
DESIGNED BY CHECKED BY DRAWN BY APPROVED BY DATE	DATE BY DATE
SEP. 1944	

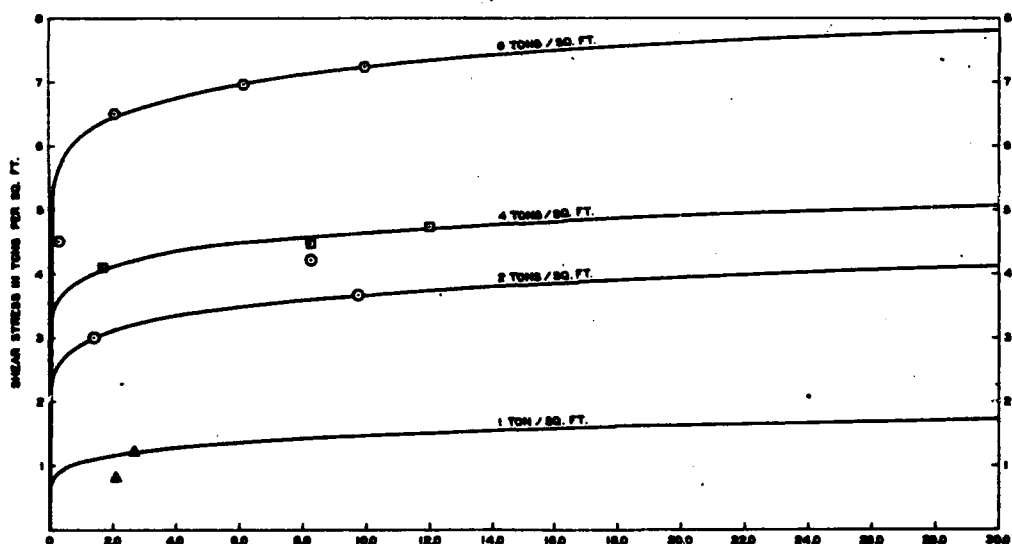
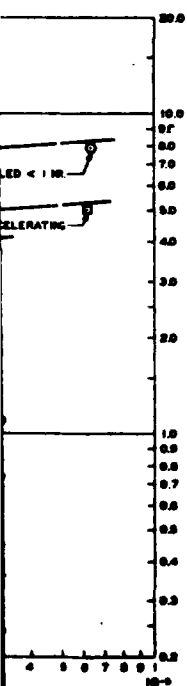
2



LEGEND:
 ▲ 1 TON
 ○ 2 TONS
 □ 4 TONS
 ⊙ 6 TONS



RATE OF STRAIN IN INCHES PER MINUTE
BENTONITE SAMPLE U-20



RATE OF STRAIN IN INCHES PER MINUTE X 10^{-7}
SAMPLE U-23 DH 85-11
ARITHMETIC PLOT

LEGEND:
 ▲ 1 TON
 ○ 2 TONS
 □ 4 TONS
 ● 8 TONS



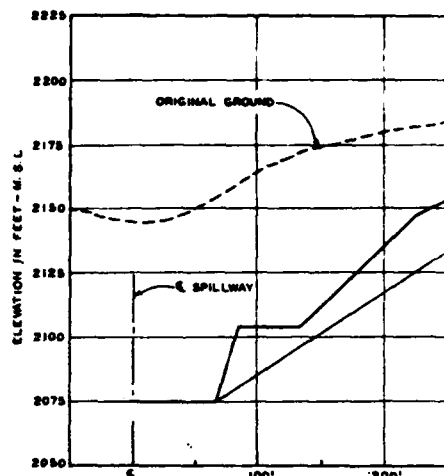
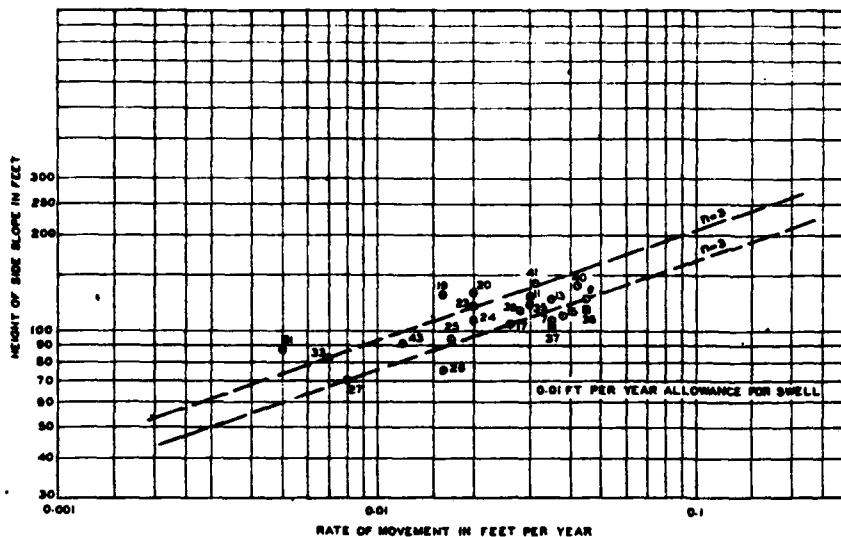
THIS SPECIFICATION HAS BEEN REDUCED TO
 THREE EIGHTH THE ORIGINAL SIZE.

THIS PLAN ASSUMES CERTAINITY OF
 DESIGN AND CONSTRUCTION.

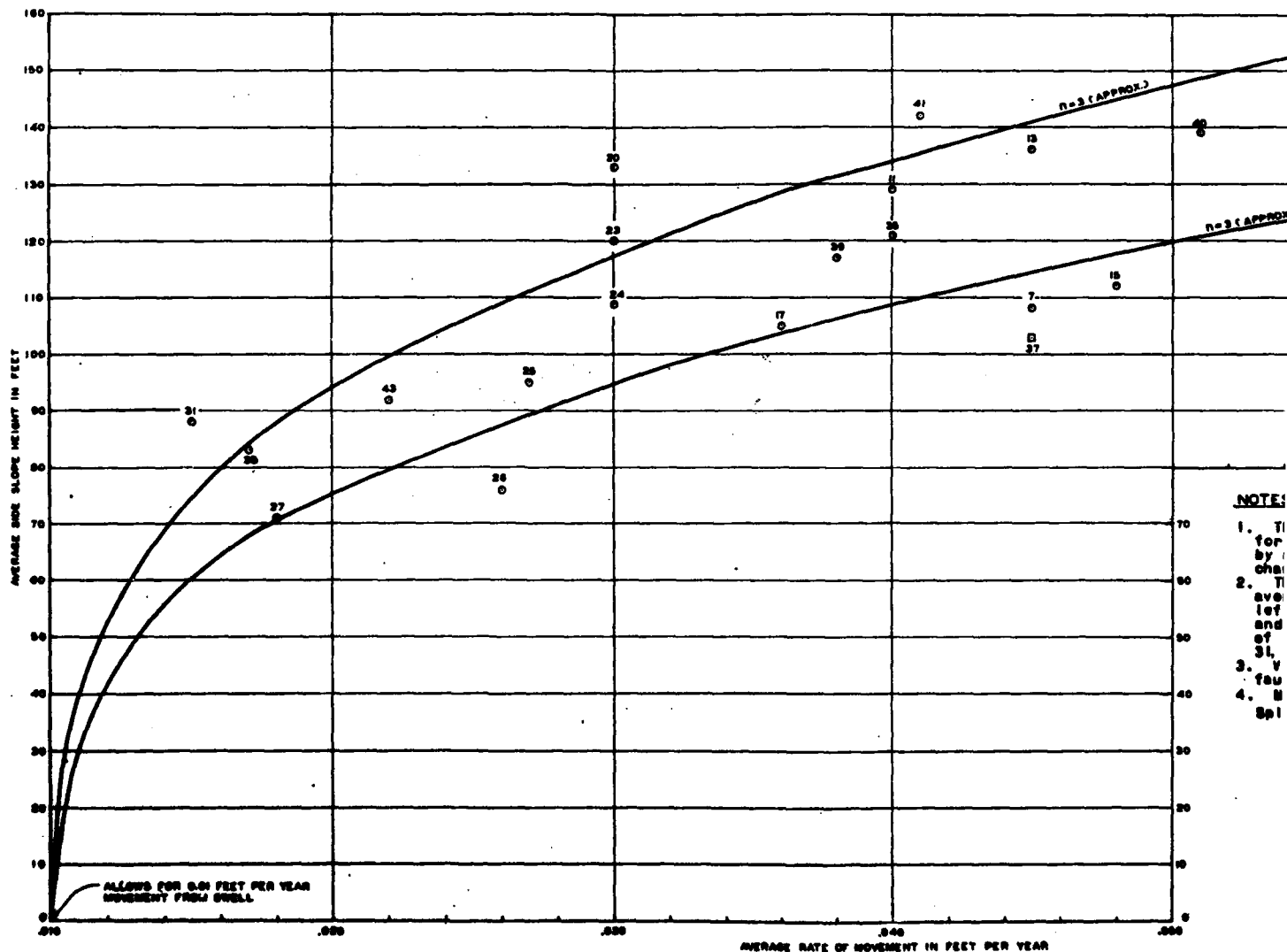
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA	
DESIGNED BY F. A. J.	CHECKED BY F. A. J.
DRAWN BY S. W. A.	APPROVED BY [Signature]
FORT PECK DAM AND RESERVOIR SPILLWAY REHABILITATION RATE OF STRAIN VS STRESS DIRECT SHEAR TESTS	
DATE SEPT. 1958	SCALE 1/4" = 1' HORIZ. 1/4" = 10' VERT.

2

CORPS OF ENGINEERS



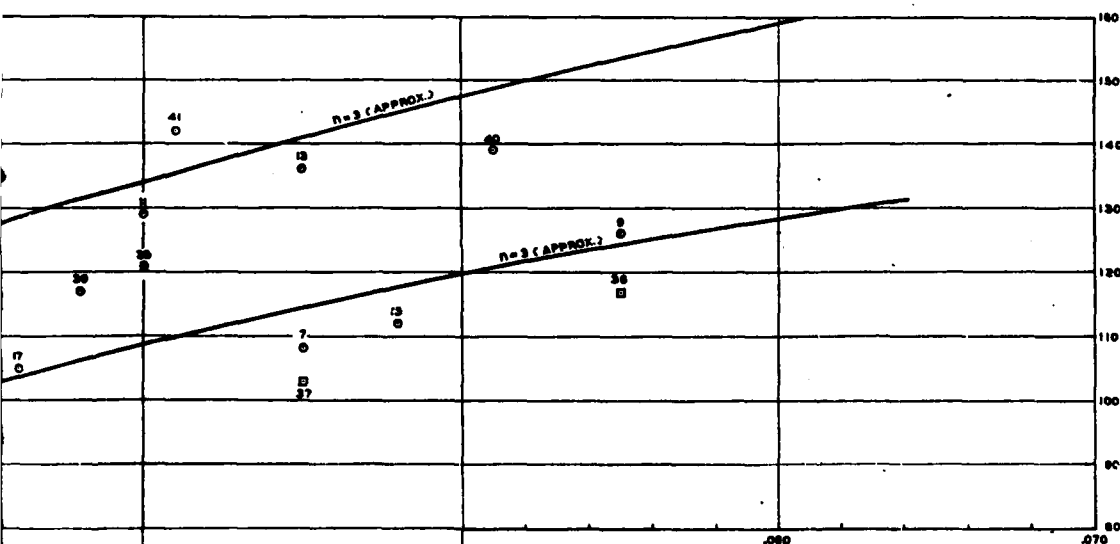
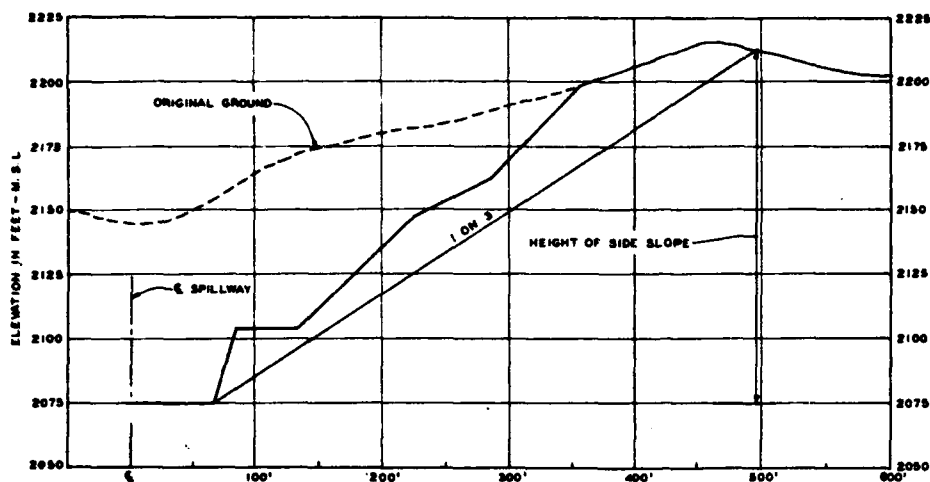
TYPIC



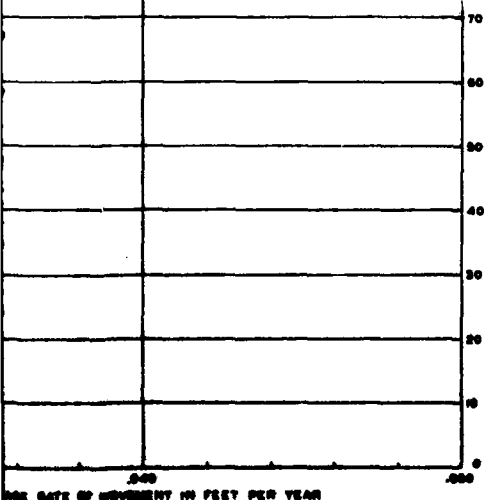
NOTES

1. TYPIC
2. for
3. by
4. char
5. ave
6. let
7. and
8. of
9. 31
10. v
11. fou
12. 4
13. B
14. Spl

THIS DRAWING HAS BEEN REDUCED TO THREE-FIFTHS THE ORIGINAL SCALE.

**NOTES:**

1. The average rate of movement per section for the period 1949 through 1960 computed by averaging all movement points across the channel floor for each section.
2. The average side slope height computed by averaging the slope heights for right and left side and including the station upstream and downstream in the average, i.e., an average of 6 values for each section. Below station 31, right side only used.
3. Values shown by \square (square) effected by fault.
4. Numbered Points \circ or \square represent Spillway stations.



THIS GRAPHING HAS BEEN REDUCED TO
THREE-FOURTHS THE ORIGINAL SCALE.



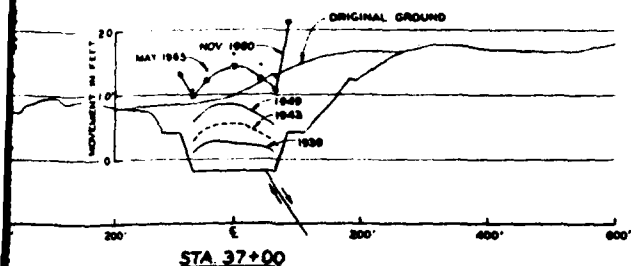
THIS PLAN ASSUMES CONTRACT NO. 10-50-000-100
RECONSTRUCTION NO.

U. S. ARMY ENGINEER DISTRICT, CHAMPA		100000 RIVER	
GROUP OF ENGINEERS		FORT PECK DAM AND RESERVOIR	
CHAMPA, MINNESOTA		SPILLWAY REHABILITATION	
DESIGNED BY C.E.J.-D.W.		AVERAGE RATE OF MOVEMENT	
CHECKED BY S.A.		VS. AVERAGE SIDE SLOPE HEIGHT	
DESIGNED BY S.A.		DATE SEPT. 1960	
CHECKED BY S.A.		DRAWN BY	
APPROVED BY		DATE	
APPROVED BY		DATE	

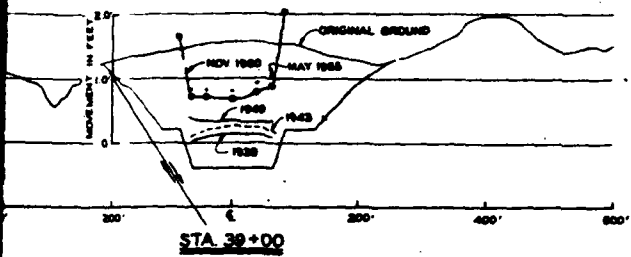
CONSTRUCTION FOUNDATION REPORT

PLATE 132

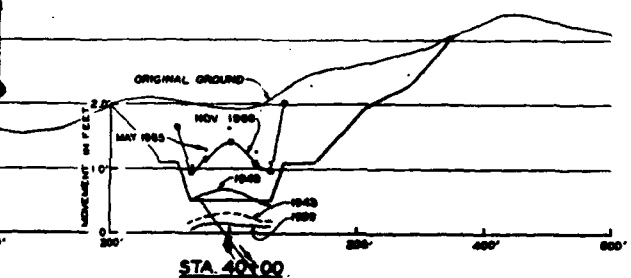
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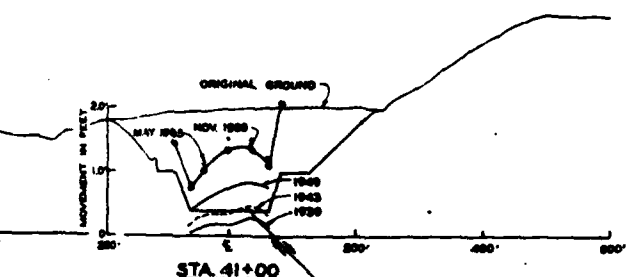
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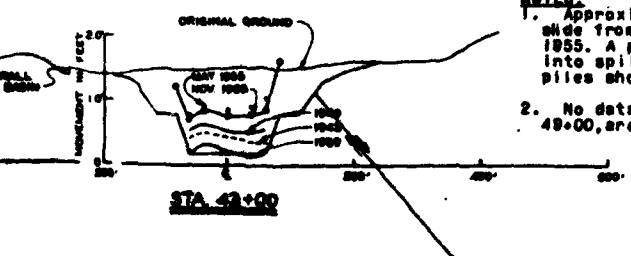
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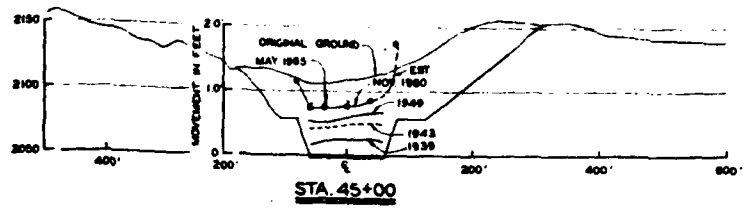
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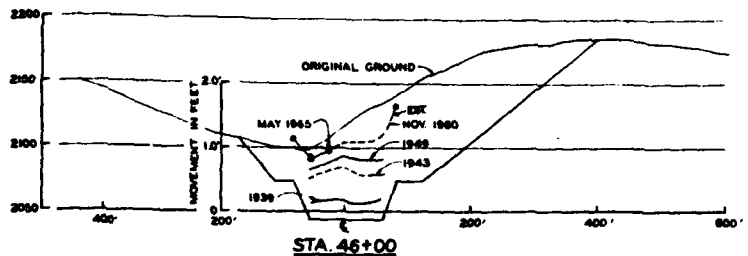
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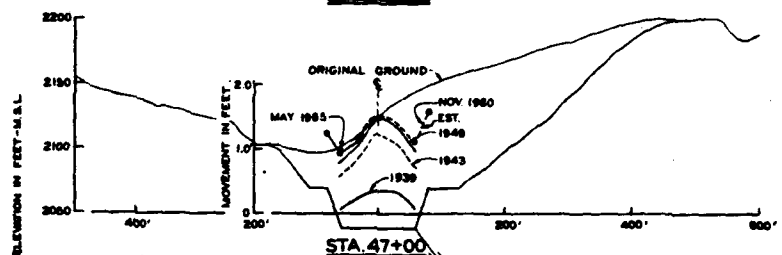
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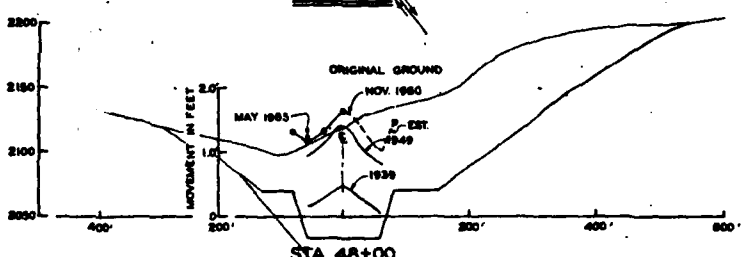
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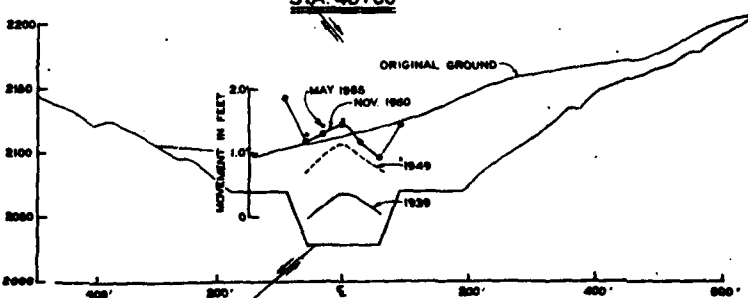
STA 46+00



STA 47+00



STA 48+00



STA 49+00

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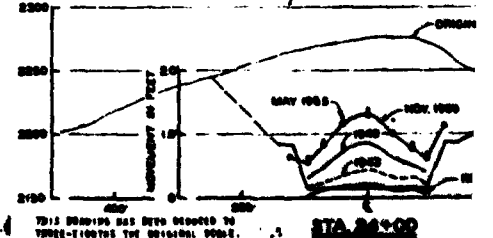
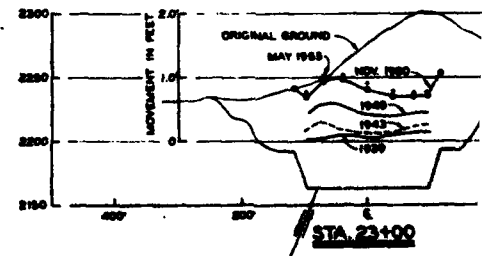
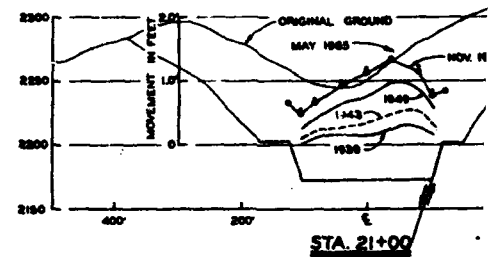
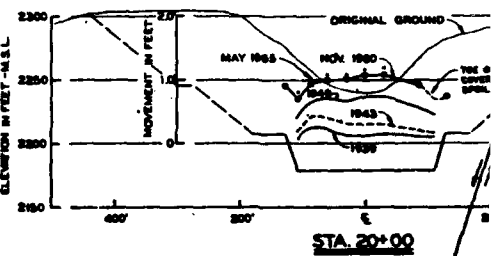
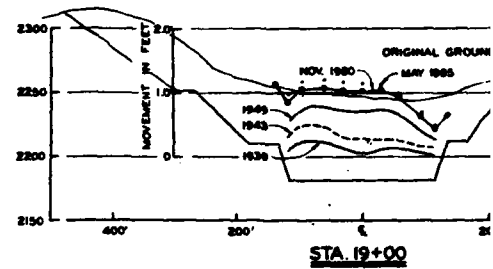
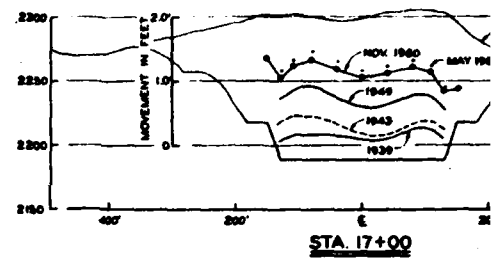
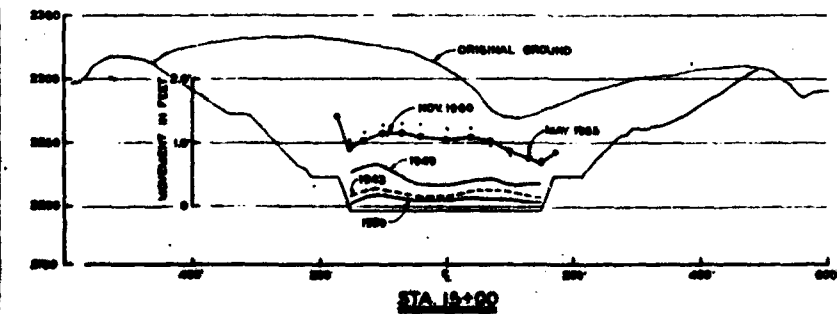
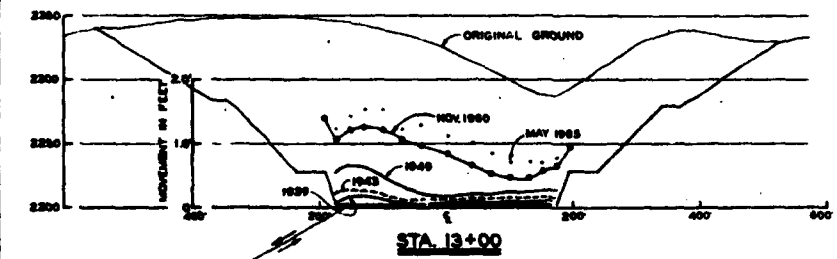
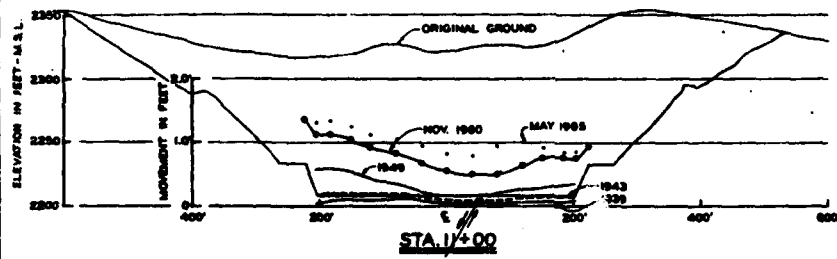
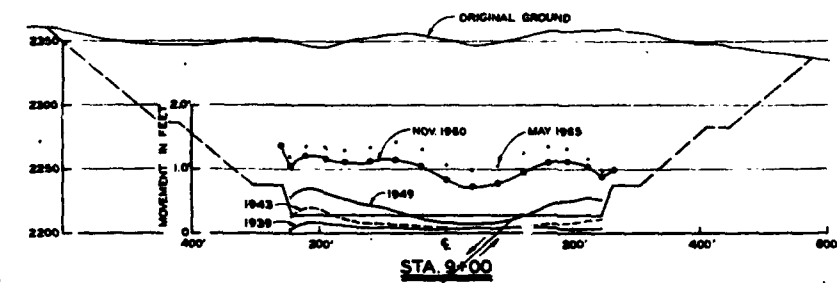
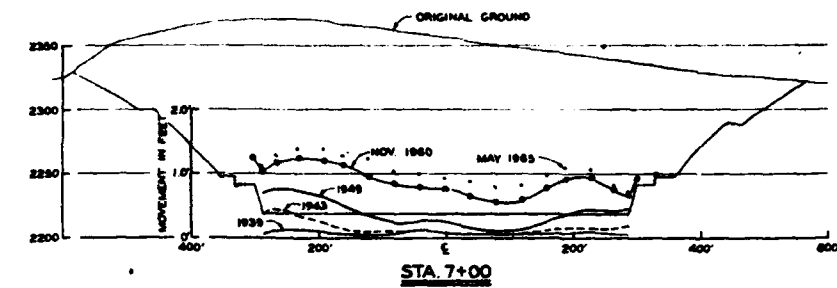
1. Approximately 15,000 cu. yds. of material slide from right side slope after rain in 1955. A portion of this material was wasted into spillway channel causing the spoil piles shown on sections 45.00 to 48.00.
2. No data for 1943 at sta. 49.00 and 48.00, area covered by water.



U. S. ARMY ENGINEER DISTRICT, CHAMPAIGN BRANCH OF ENGINEERS CHAMPAIGN, ILLINOIS	
MISSOURI RIVER FORT PECK DAM AND RESERVOIR SPILLWAY REHABILITATION STUDY OF CROSS SECT. & VERTICAL MOVEMENT STATION 31+00 THRU 48+00	
DESIGNED BY: E. J. [Signature]	DATE: SEPT 1955
CHECKED BY: E. J. [Signature]	DATE: [Blank]
APPROVED BY: [Signature]	DATE: [Blank]
[Blank space for additional notes or signatures]	

2

CORPS OF ENGINEERS



THIS DRAWING HAS BEEN REDUCED TO
THREE-FIFTHS THE ORIGINAL SIZE.

AD A134 914

CONSTRUCTION FOUNDATION REPORT MISSOURI RIVER FORT PECK
MONTANA VOLUME 2 DRAWINGS(U) ARMY ENGINEER DISTRICT
OMAHA NE JAN 83

4/4

UNCLASSIFIED

F/G 13/13

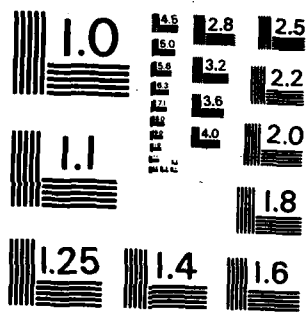
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END

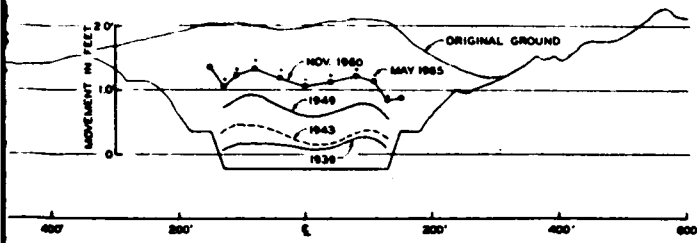
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2/12/83

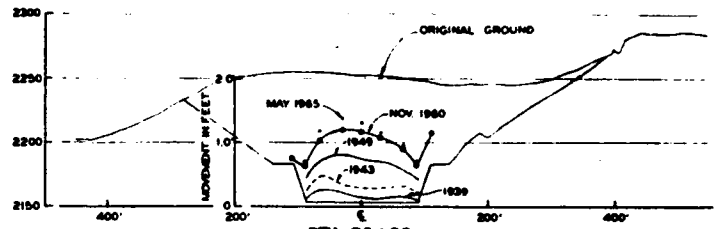
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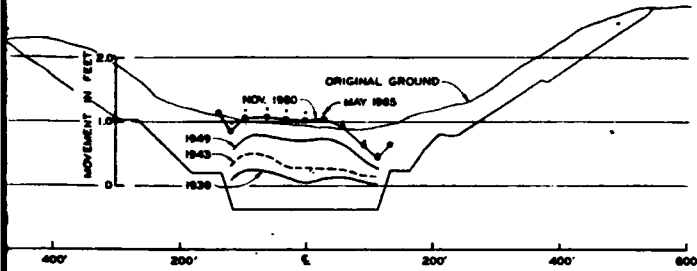
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



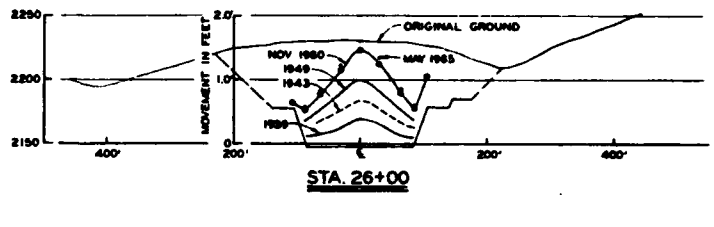
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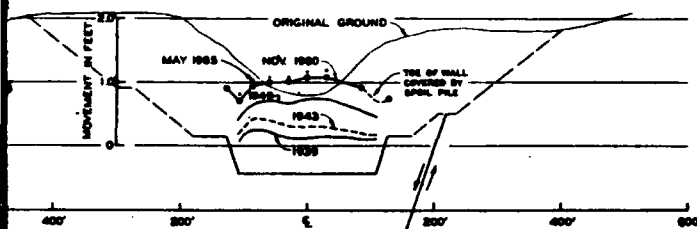
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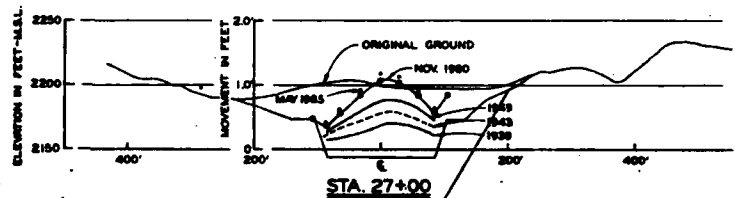
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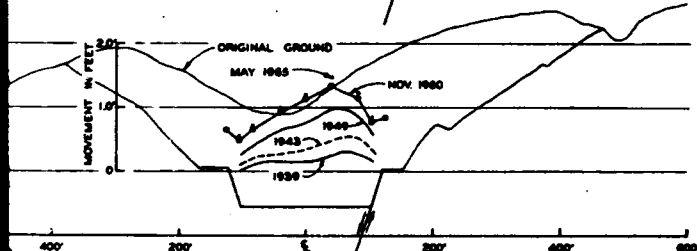
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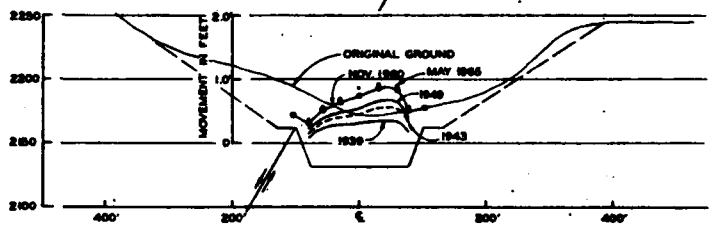
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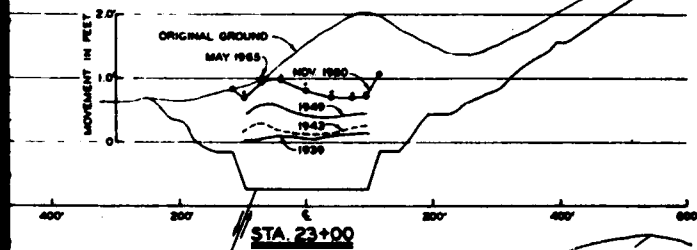
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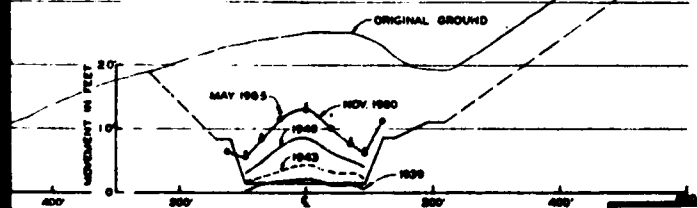
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STA. 29+00



STA. 23+00

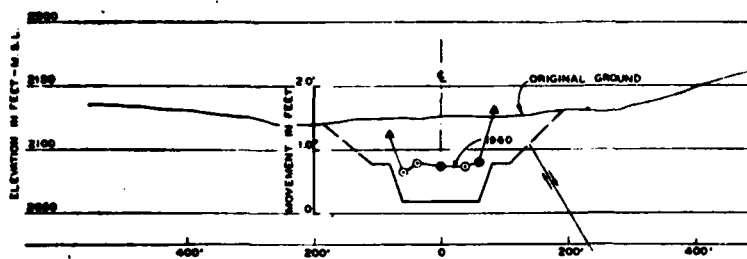


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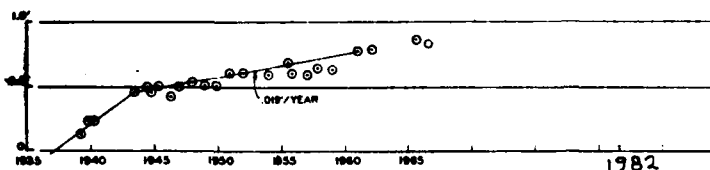


DATE		REVISION		NAME	STATUS
U. S. ARMY ENGINEER DISTRICT, OMAHA GROUP OF ENGINEERS OMAHA, NEBRASKA					
WABASH RIVER FORT PECK DAM AND RESERVOIR SPILLWAY REHABILITATION STUDY OF CROSS SECTIONS AND VERTICAL MOVEMENT STATION 7+00 THRU 29+00					
DESIGNED BY	C.E.J.	CHECKED BY	C.E.A.	DATE	SEPT 1965
DRAWN BY	C.E.A.	APPROVED BY	C.E.A.	DATE	SEPT 1965
PROJECTED BY		CHECKED BY		DATE	
PROJECTED BY		CHECKED BY		DATE	
PROJECTED BY		CHECKED BY		DATE	

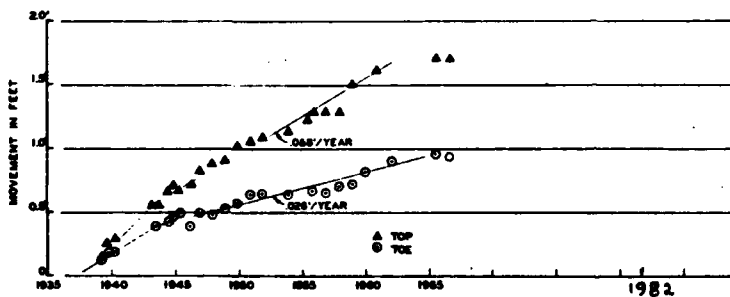
CORPS OF ENGINEERS



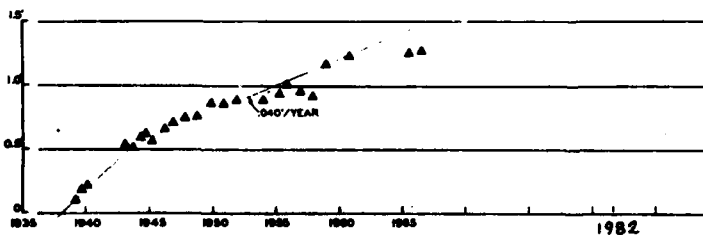
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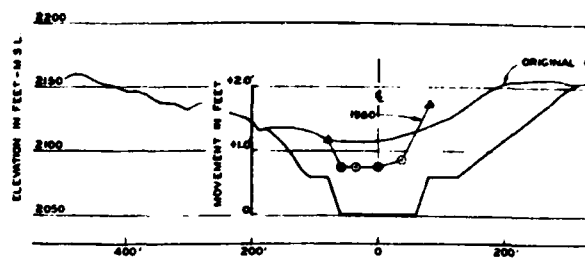
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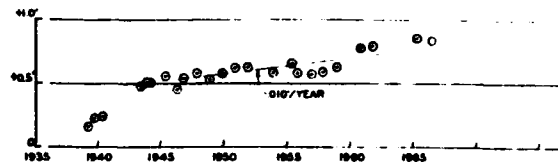
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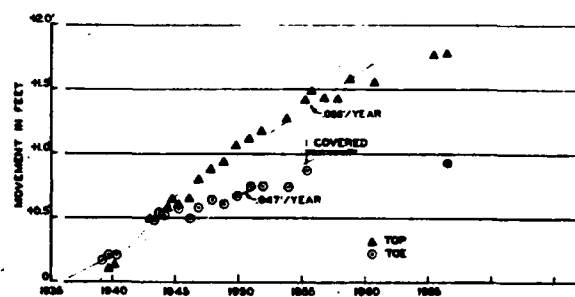
TOP-LEFT WALL
TIME MOVEMENT GRAPHS



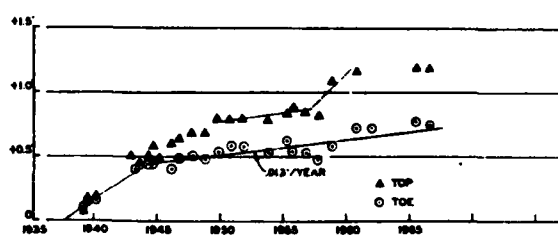
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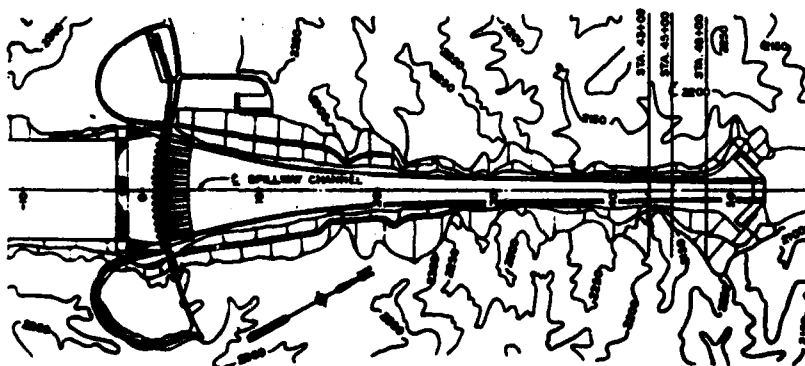
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RIGHT WALL

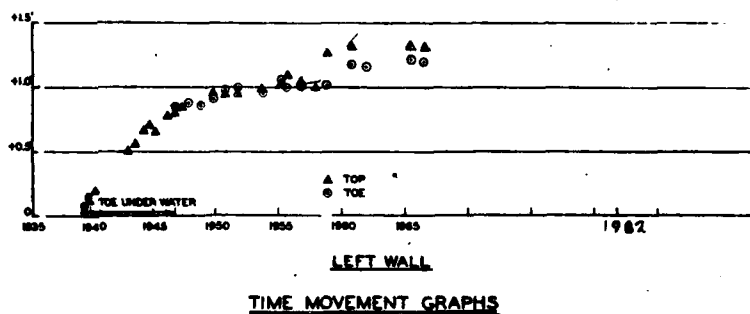
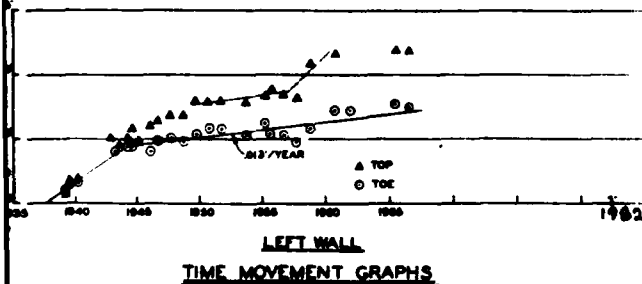
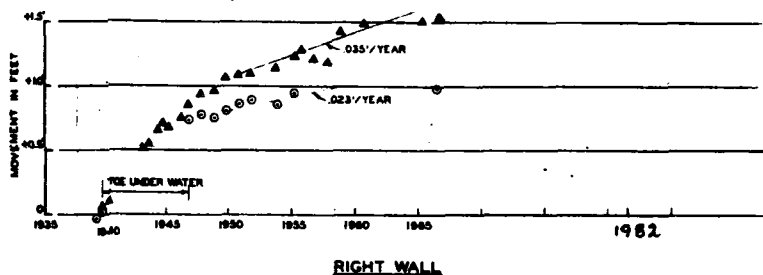
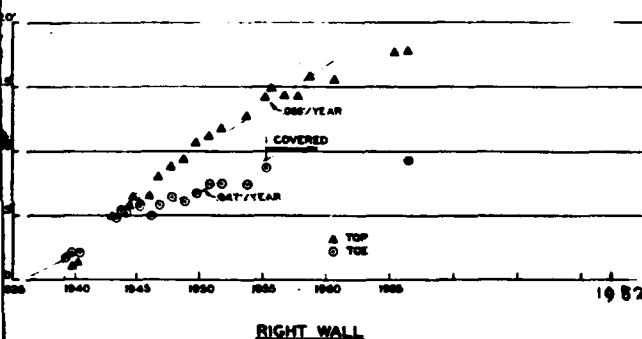
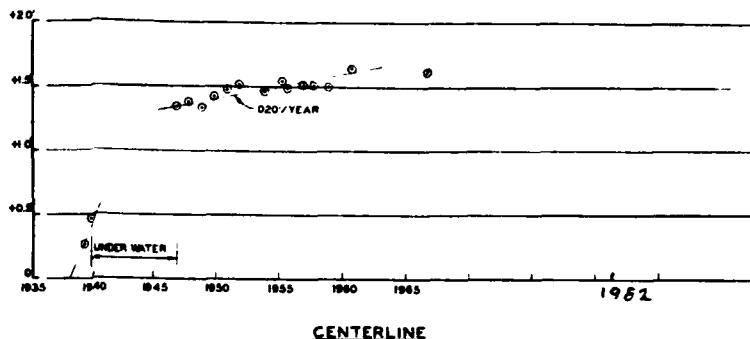
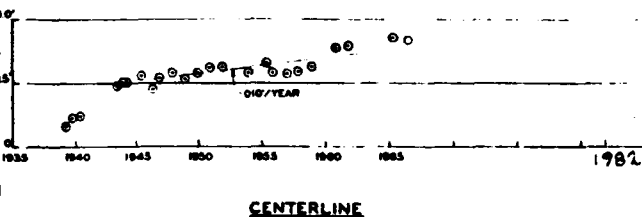
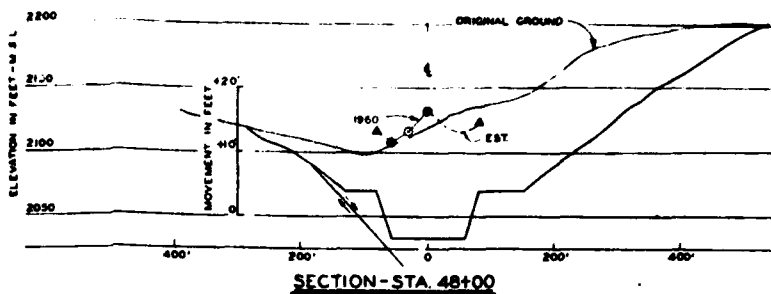
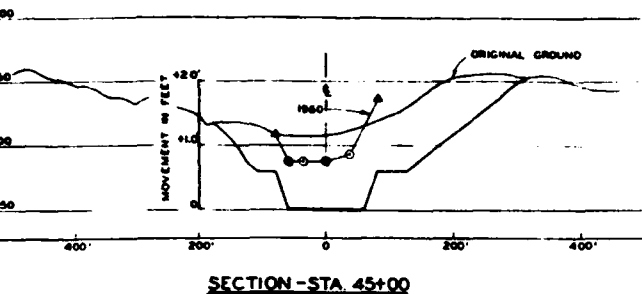


LEFT WALL
TIME MOVEMENT GRAPHS



KEY PLAN

THIS DRAWING HAS BEEN REDUCED TO
100% OF THE ORIGINAL SCALE.



TIME MOVEMENT GRAPHS

TIME MOVEMENT GRAPHS

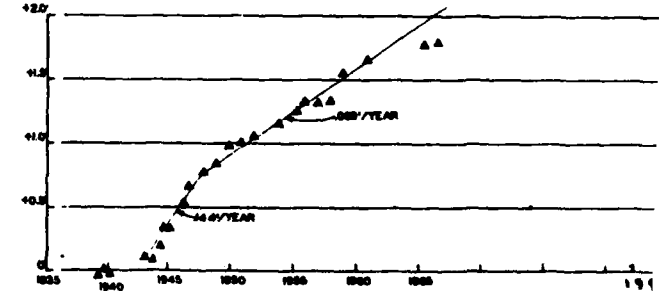
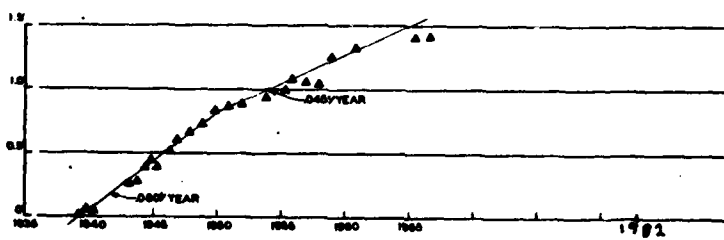
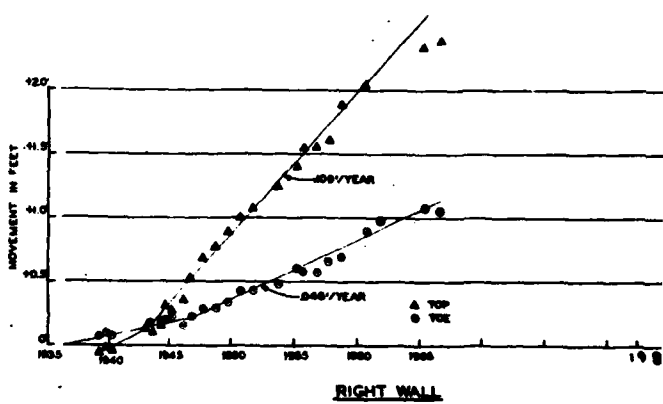
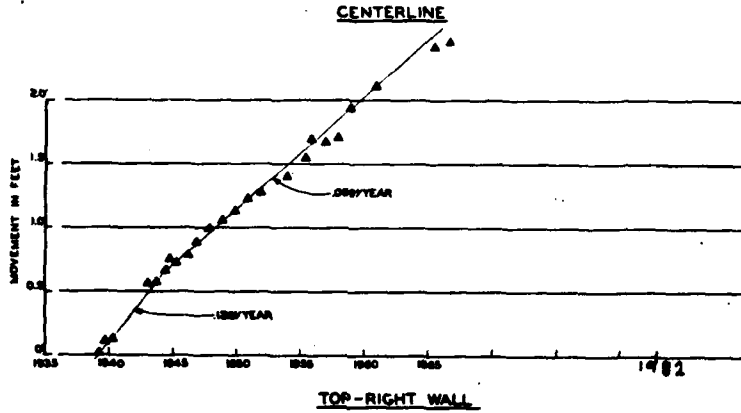
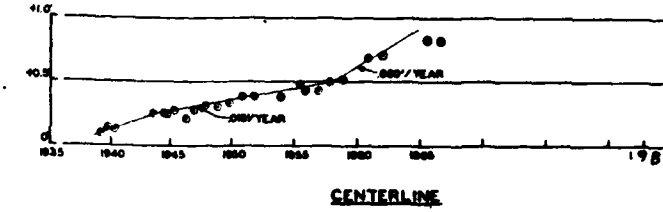
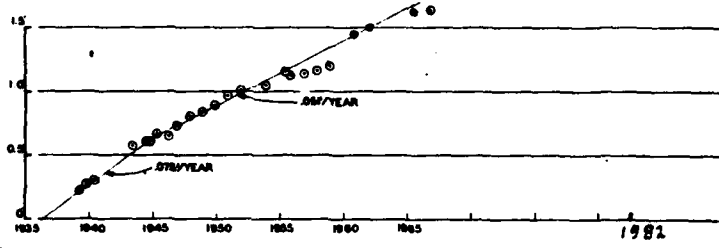
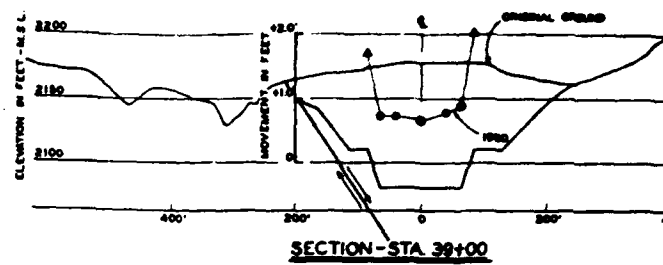
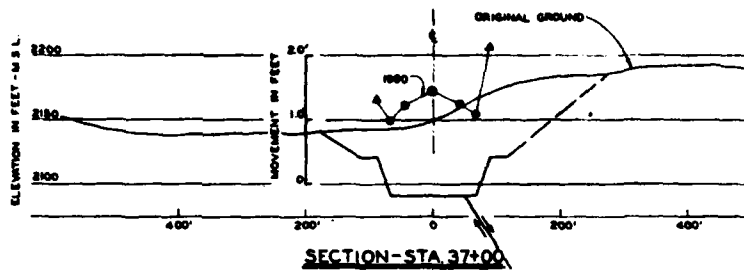
DATE		REVISIONS		NO.	REV.
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DESIGNED BY: C. J. J.		CHECKED BY: H. B. J.		APPROVED BY: H. B. J.	
DRAWN BY: S. P. J.		CHECKED BY: S. P. J.		APPROVED BY: S. P. J.	
CALCULATED BY: S. P. J.		CHECKED BY: S. P. J.		APPROVED BY: S. P. J.	
IN CHARGE: J. R. J.		CHECKED BY: J. R. J.		APPROVED BY: J. R. J.	
DATE: SEPT. 1960		DATE: SEPT. 1960		DATE: SEPT. 1960	
BY: J. R. J.		BY: J. R. J.		BY: J. R. J.	
FOR: J. R. J.		FOR: J. R. J.		FOR: J. R. J.	
BY: J. R. J.		BY: J. R. J.		BY: J. R. J.	
FOR: J. R. J.		FOR: J. R. J.		FOR: J. R. J.	



THIS PLAN ACCOMPANIES CONTRACT NO. 6A-50-000-100
CONSTRUCTION NO.

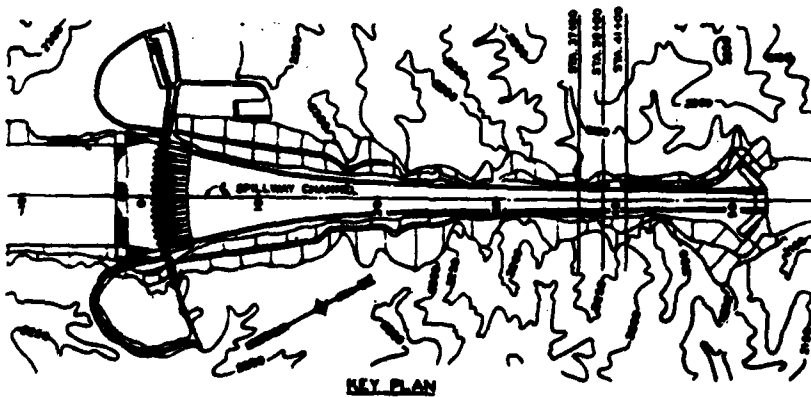
2

CORPS OF ENGINEERS



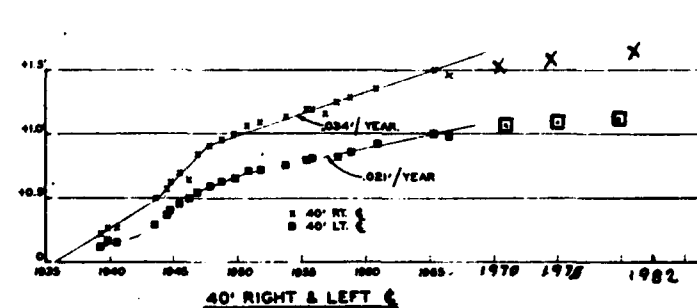
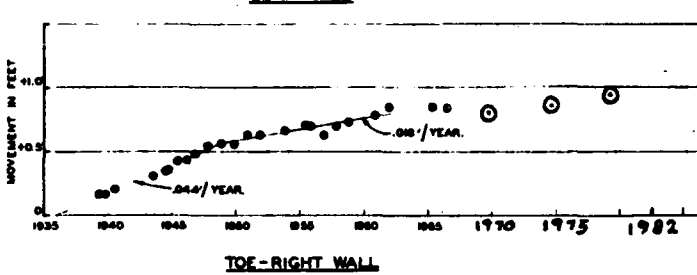
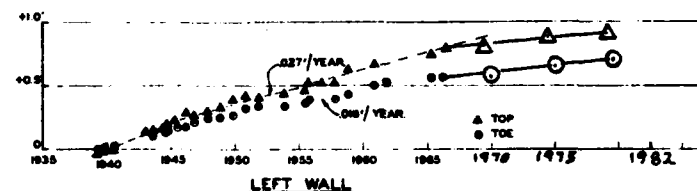
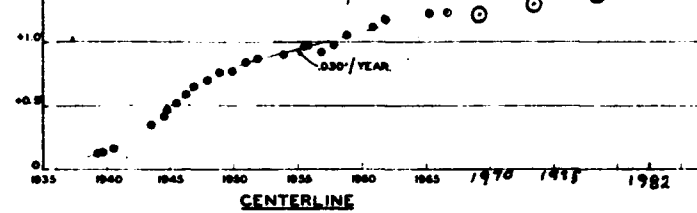
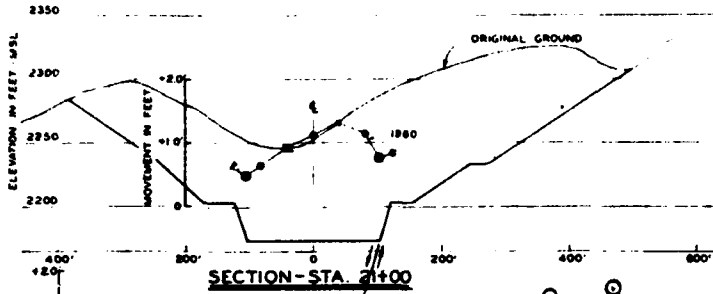
TIME MOVEMENT GRAPHS

TIME MOVEMENT GRAPHS

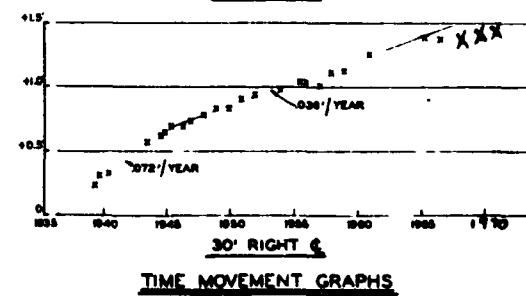
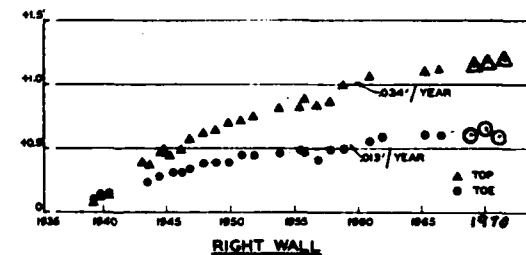
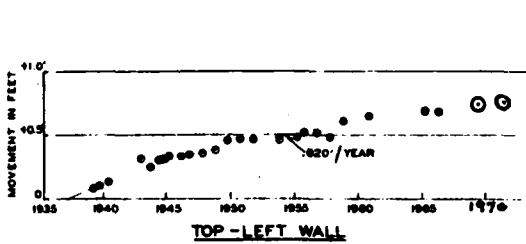
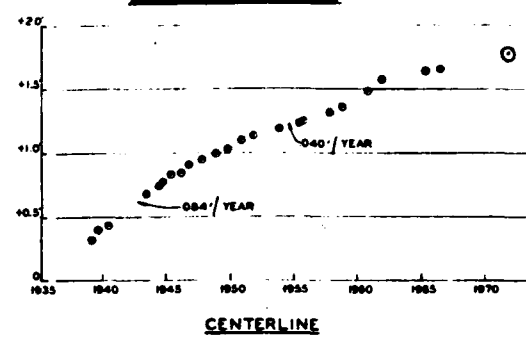
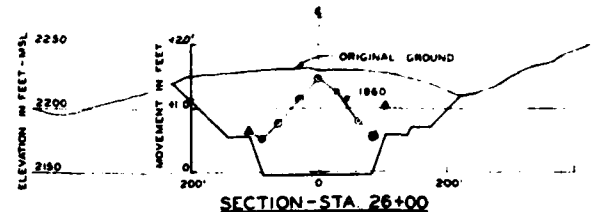
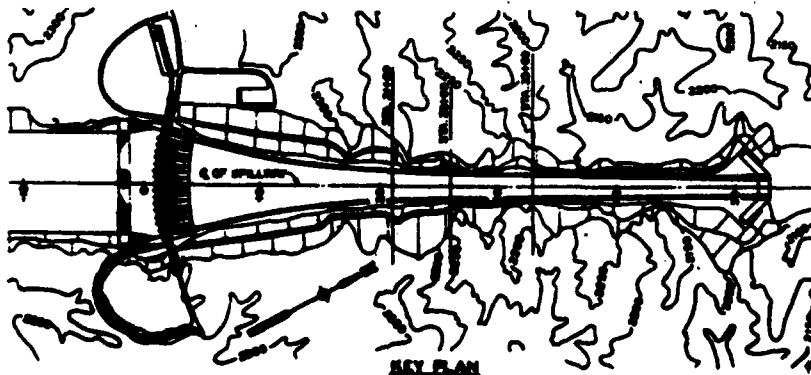


THIS DRAWING HAS BEEN REDUCED TO THREE-FIFTHS THE ORIGINAL SCALE.

CORPS OF ENGINEERS



TIME MOVEMENT GRAPHS



TIME MOVEMENT GRAPHS

THIS DRAWING HAS BEEN REDUCED TO
FOUR-FIFTHS THE ORIGINAL SCALE.

Figure 1 is a scatter plot showing the relationship between the year of publication (X-axis) and the number of citations (Y-axis). The X-axis ranges from 1935 to 1980, and the Y-axis ranges from 0 to 5. Data points are plotted for each year from 1935 to 1975. Two linear regression lines are shown: one for the period 1935-1955 with a slope of 0.84/YEAR, and another for the period 1955-1975 with a slope of 0.40/YEAR. The data points show a general upward trend, with a slight change in slope around 1955.

The graph illustrates the rate of change in the labor force over time. The Y-axis is labeled with values 0, +0.5, +1.0, and +1.5. The X-axis is labeled with years 1935, 1940, 1945, 1950, 1955, 1960, 1965, 1970, 1975, and 1982. A curve starts at approximately (1935, 0.2) and rises steadily to approximately (1992, 0.8). A label '0.72%/YEAR' with an arrow points to the start of the curve, and another label '0.7%/YEAR' with an arrow points to the end of the curve.

Figure 1 is a scatter plot showing the relationship between the year of publication (X-axis) and the number of citations (Y-axis). The X-axis ranges from 1935 to 1980, and the Y-axis ranges from 0 to 10. A dashed line indicates a trend of 0.20 citations per year. Data points are plotted for various years, with some points circled to highlight specific data.

Year	Citations
1935	0.5
1936	0.8
1937	1.2
1938	1.5
1939	1.8
1940	2.2
1941	2.5
1942	2.8
1943	3.2
1944	3.5
1945	3.8
1946	4.2
1947	4.5
1948	4.8
1949	5.2
1950	5.5
1951	5.8
1952	6.2
1953	6.5
1954	6.8
1955	7.2
1956	7.5
1957	7.8
1958	8.2
1959	8.5
1960	8.8
1961	9.2
1962	9.5
1963	9.8
1964	10.2
1965	10.5
1966	10.8
1967	11.2
1968	11.5
1969	11.8
1970	12.2
1971	12.5
1972	12.8
1973	13.2
1974	13.5
1975	13.8
1976	14.2
1977	14.5
1978	14.8
1979	15.2
1980	15.5

Figure 1 is a line graph showing the rate of change of the topographic index (TOE) and topographic index (TOP) from 1935 to 1982. The Y-axis represents the rate of change in cm/year, ranging from 0 to 10. The X-axis represents the year, ranging from 1935 to 1982. Two data series are plotted: TOP (represented by triangles) and TOE (represented by circles). Both series show an upward trend over time. The TOP series starts around 1940 at approximately 2 cm/year and increases to about 8 cm/year by 1978. The TOE series starts around 1940 at approximately 1 cm/year and increases to about 5 cm/year by 1978. Two horizontal lines are drawn across the graph, labeled '0.34"/YEAR' and '0.12"/YEAR'.

Figure 1 is a line graph showing movement in feet over time. The vertical axis (y-axis) is labeled 'MOVEMENT IN FEET' and ranges from 0 to 11.5 in increments of 0.5. The horizontal axis (x-axis) shows years from 1935 to 1982 in 5-year increments. Data points are represented by triangles. A dashed line indicates a trend, and a label '0.25 / YEAR' with an arrow points to the line around 1950.

Year	Movement (feet)
1935	0.0
1940	0.0
1941	0.1
1942	0.2
1943	0.3
1944	0.4
1945	0.5
1946	0.6
1947	0.7
1948	0.8
1949	0.9
1950	1.0
1951	1.1
1952	1.2
1953	1.3
1954	1.4
1955	1.5
1956	1.6
1957	1.7
1958	1.8
1959	1.9
1960	2.0
1961	2.1
1962	2.2
1963	2.3
1964	2.4
1965	2.5
1966	2.6
1967	2.7
1968	2.8
1969	2.9
1970	3.0
1971	3.1
1972	3.2
1973	3.3
1974	3.4
1975	3.5
1976	3.6
1977	3.7
1978	3.8
1979	3.9
1980	4.0
1981	4.1
1982	4.2

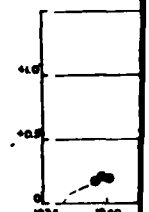
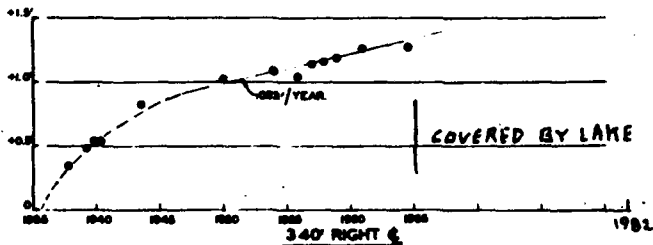
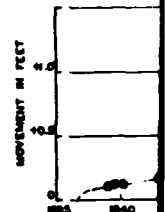
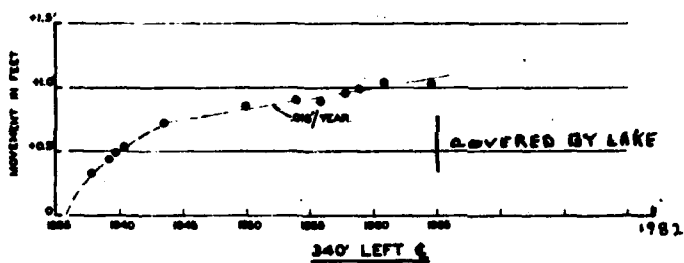
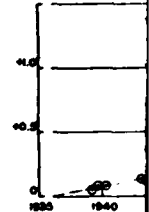
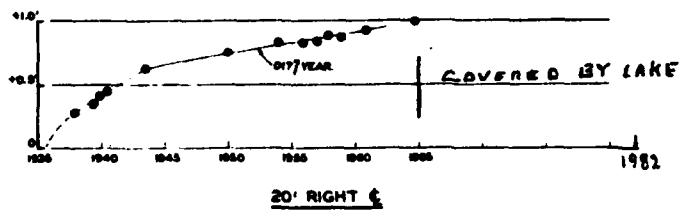
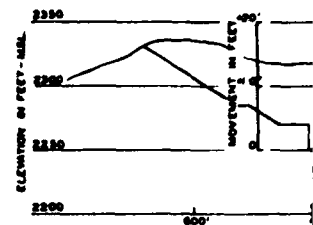
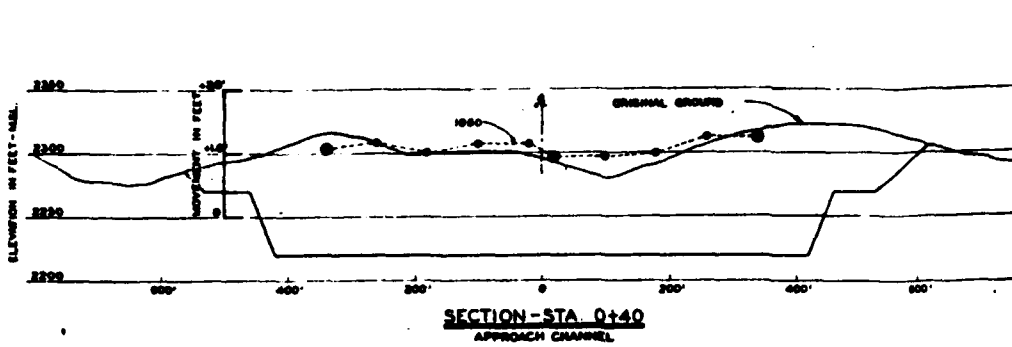
The graph illustrates a significant and steady increase in the number of deaths from stomach cancer in the United States over a 46-year period. The data points, marked by triangles, show a consistent upward trend. A dashed line is drawn through the data, with a label '233/YEAR' indicating the slope of the trend line.

Year	Number of Deaths (approximate)
1936	10
1940	20
1944	30
1948	40
1950	50
1952	60
1954	70
1956	80
1958	90
1960	100
1962	110
1964	120
1966	130
1968	140
1970	150
1972	160
1974	170
1976	180
1978	190
1980	200
1982	210

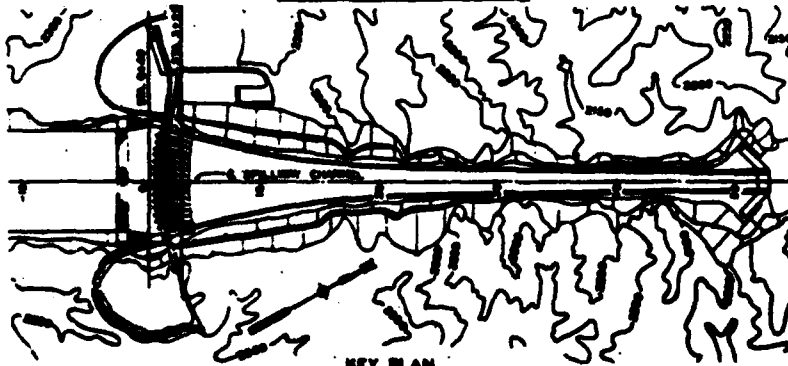
DATE	CLASSIFICATION	GRADE	APPROVAL
05112000			
U. S. ARMY ENGINEER DISTRICT, OMAHA GROUP OF ENGINEERS OMAHA, NEBRASKA			
DESIGNED BY	MISSOURI RIVER		
DESIGNED ON	FORT PECK DAM AND RESERVOIR		
DESIGNED BY	SPILLWAY REHABILITATION		
DESIGNED ON	CHANNEL SECTIONS STA. 21+00.20+00&33+00		
DESIGNED BY	VERTICAL-TIME MOVEMENT RECORDS		
APPROVED	DATE	BY	DATE
<i>[Signature]</i>	14 JUL 66	<i>[Signature]</i>	14 JUL 66
APPROVED	DATE	BY	DATE
<i>[Signature]</i>	14 JUL 66	<i>[Signature]</i>	14 JUL 66



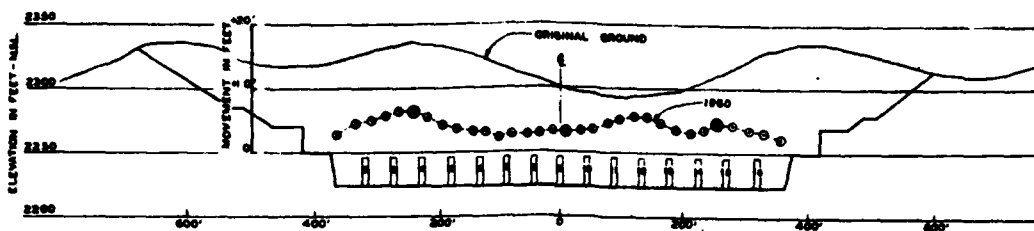
THIS PLAN ACCOMPANIES CONTRACT NO. 64-22-222-22. COOPERATION ON



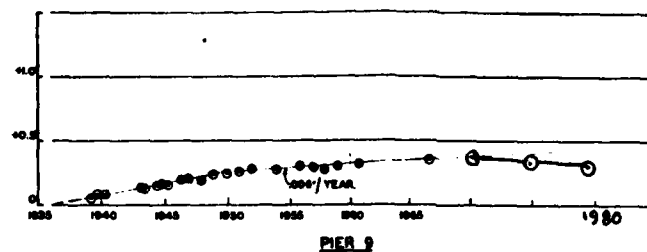
TIME MOVEMENT GRAPHS



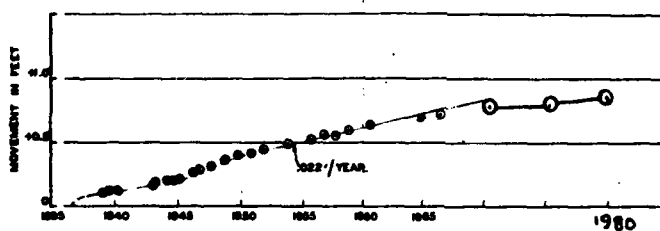
THIS DRAWING HAS BEEN REDUCED TO THREE-FIFTHS THE ORIGINAL SCALE.



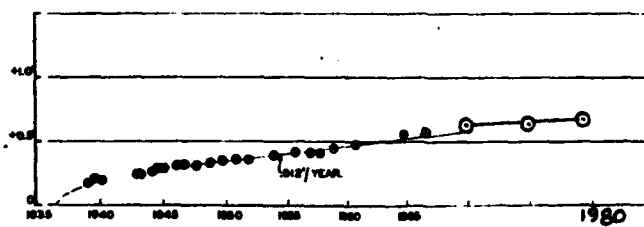
SECTION-STA. 3+25
TRAINING WALL AREA
J-LINE



PIER 9



BAY 3-4



BAY 14-15

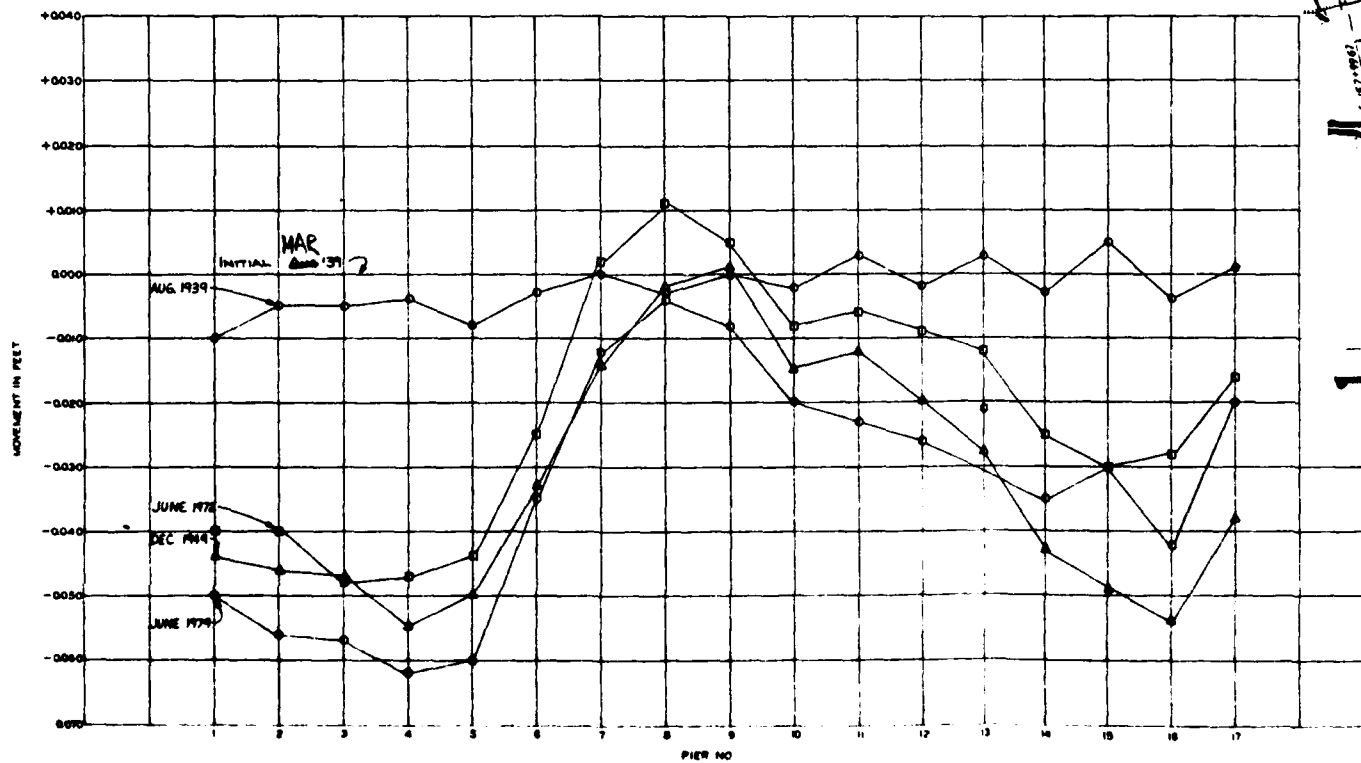
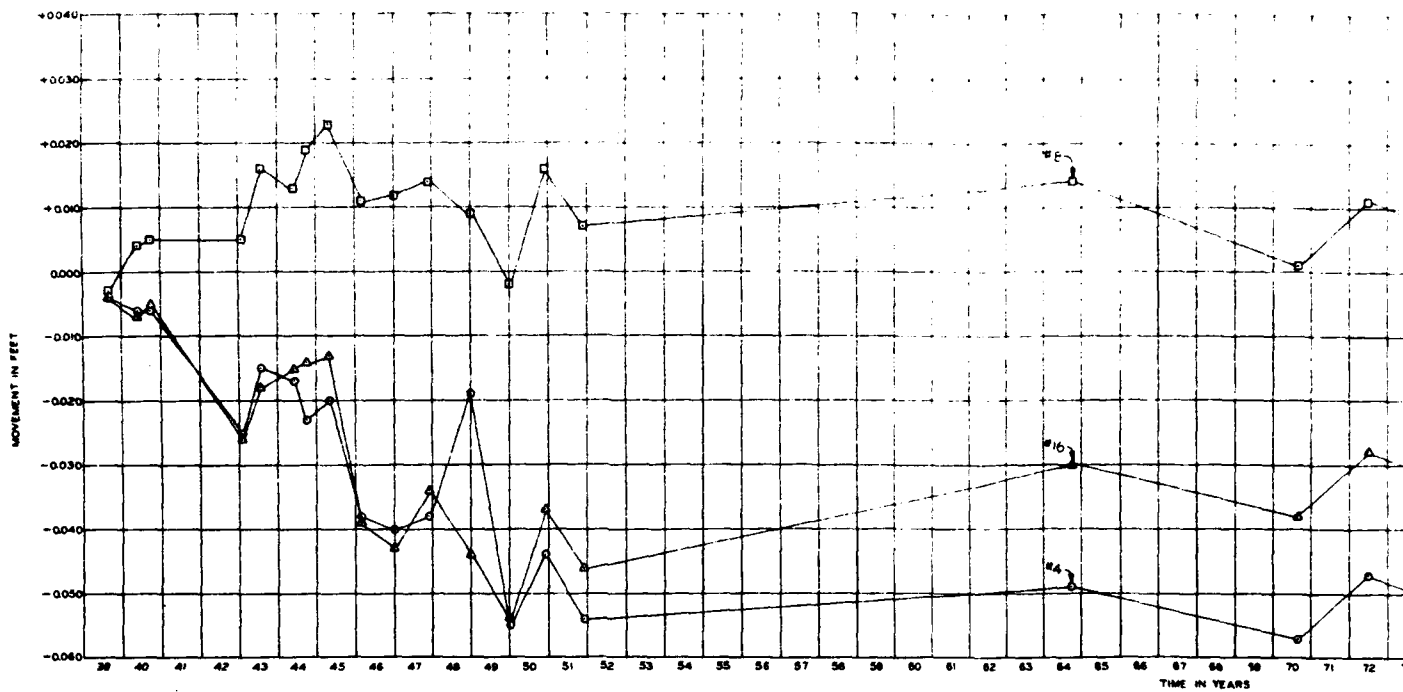
TIME MOVEMENT GRAPHS

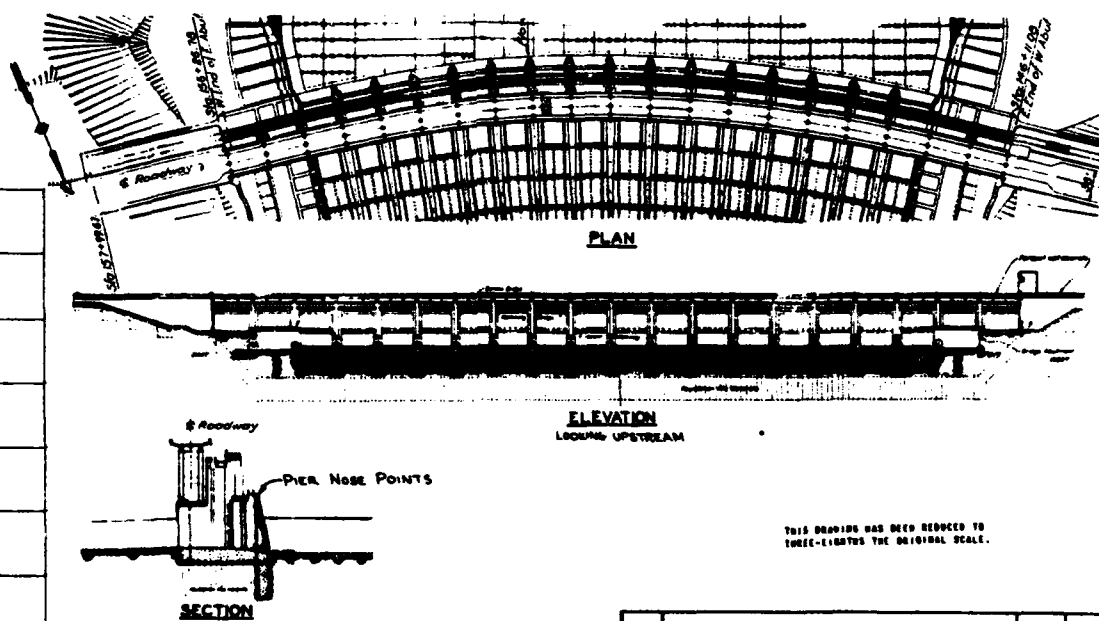
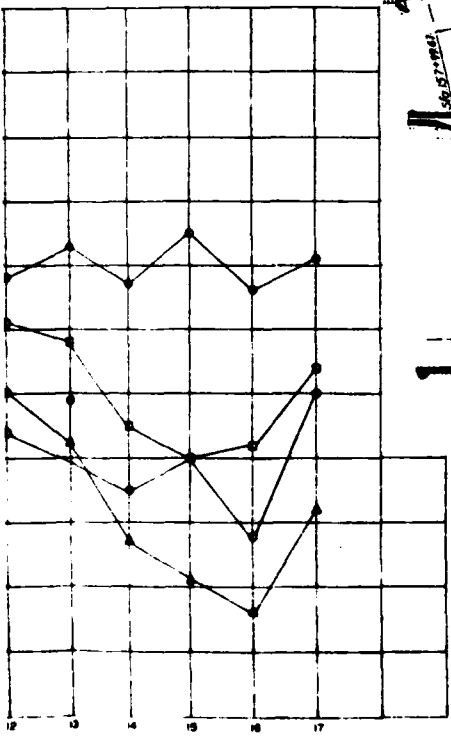
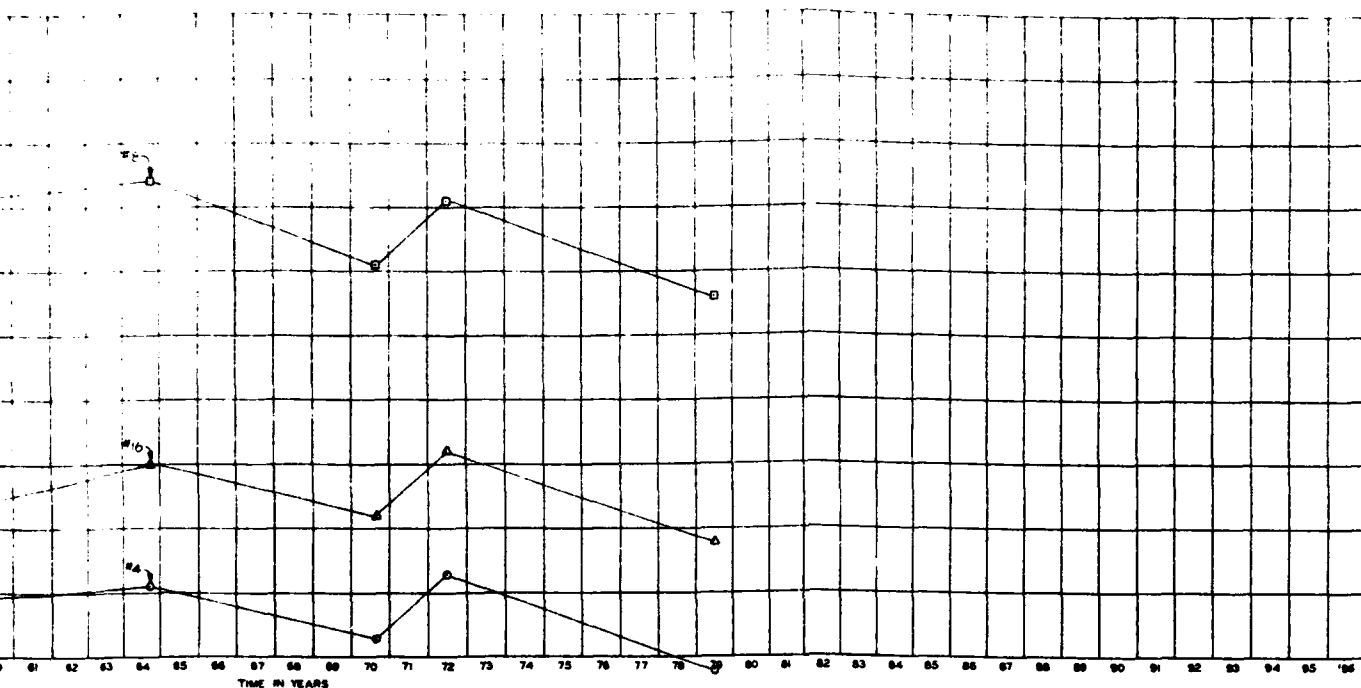


U. S. ARMY ENGINEER DISTRICT, OMAHA GROUP OF ENGINEERS OMAHA, NEBRASKA	
MISSOURI RIVER FORT PECK DAM AND RESERVOIR SPILLWAY REHABILITATION	
APPROACH CHANNEL & TRAINING WALL AREA VERTICAL-TIME MOVEMENT RECORDS	
DESIGNED BY: S.E.A. S.E.A. CHECKED BY: S.E.A. S.E.A. APPROVED BY: S.E.A. S.E.A.	DATE: SEPT 1980
<i>Charles E. Hagg</i> <i>Shirley J. Clark</i>	

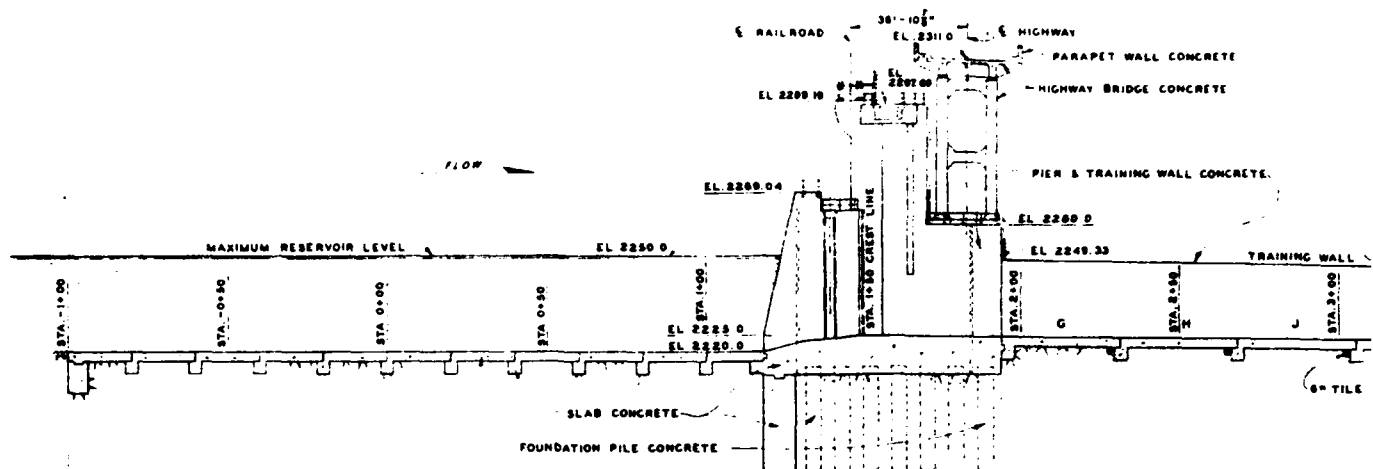
THIS PLAN ASSUMES CONTRACT NO. DA-30-000-10
MODIFICATION NO.

2





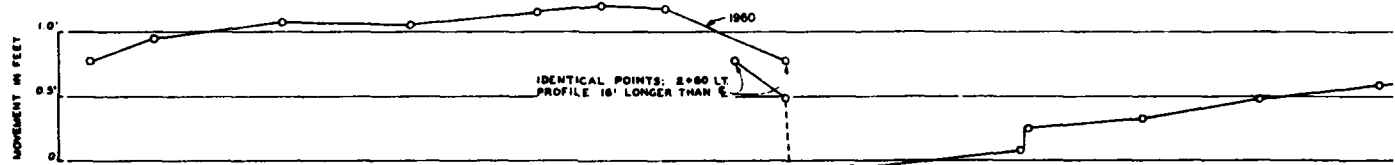
DATE	DESCRIPTION	DATE	APPROVED
DIVISION			
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA			
WISCONSIN RIVER FORT PECK LAKE, MONTANA SPILLWAY-GATE STRUCTURE VERTICAL MOVEMENT			
DESIGNED BY	CHECKED BY	DATE	SCALE
DRAWN BY	DATE	DATE	DATE
IN CHARGE	DATE	DATE	DATE
THIS PLAN ASSUMES CONTRACT NO. _____		CONTRACT NO. _____	
MODIFICATION NO. _____		MODIFICATION NO. _____	



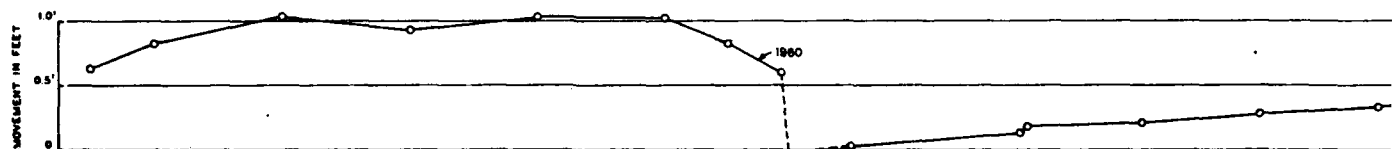
LONGITUDINAL SECTION A-A

SCALE 1 INCH = 20 FEET

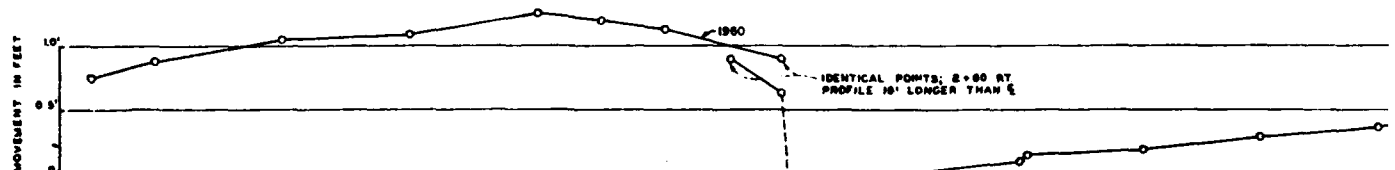
← APPROACH SLAB AREA GATE STRUCTURE TRAINING WALL AREA →



2+60 LEFT

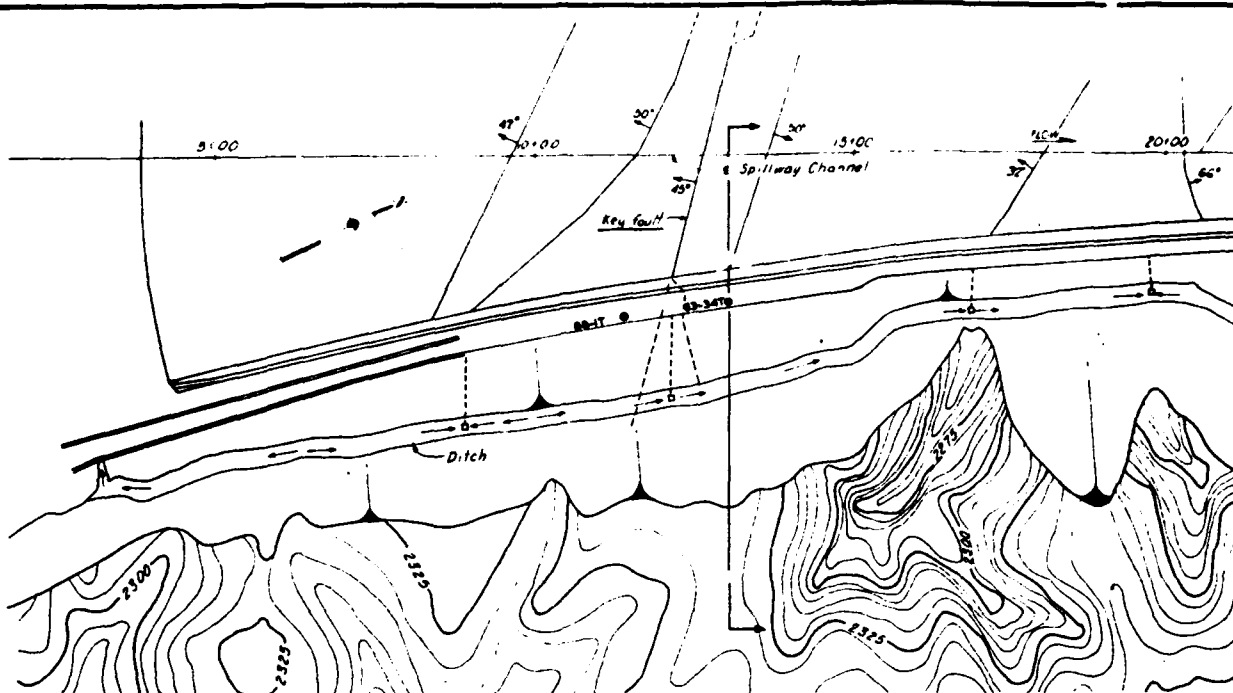


CENTERLINE

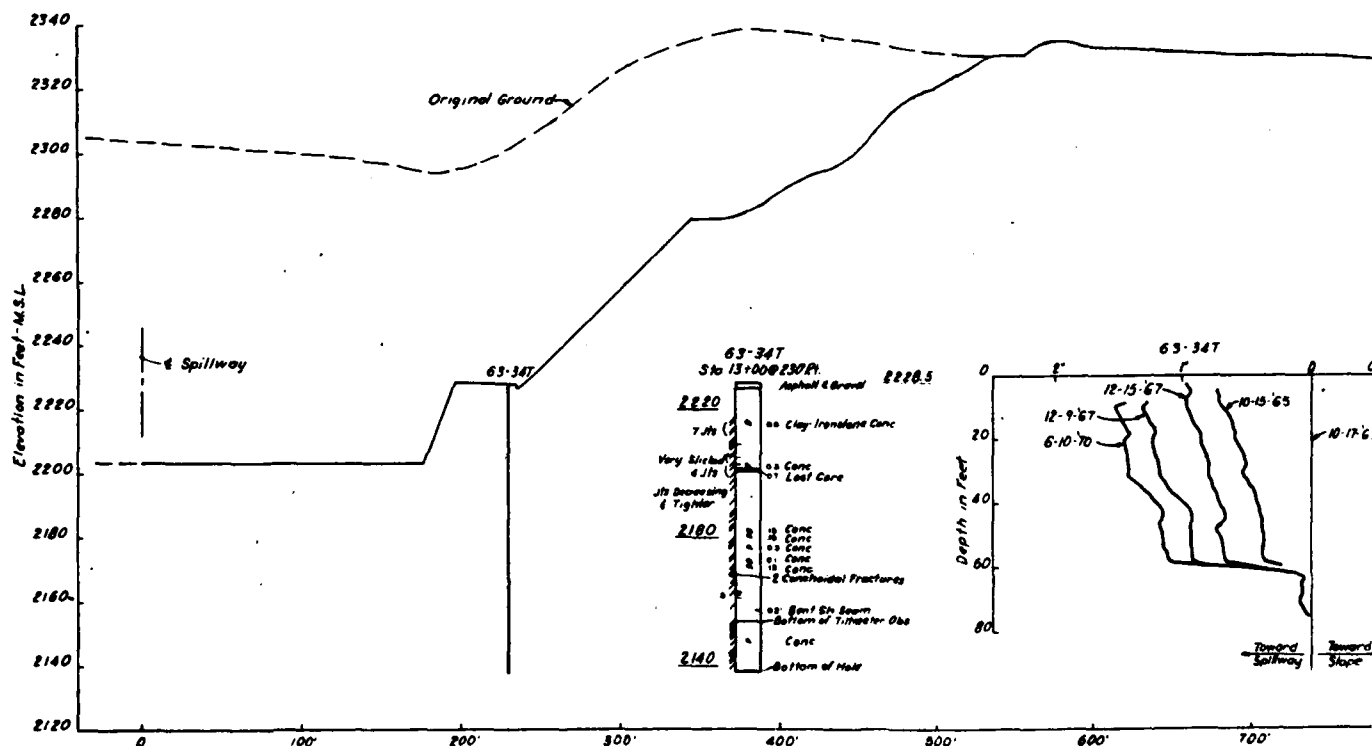


2+60 RIGHT

MOVEMENT PROFILES

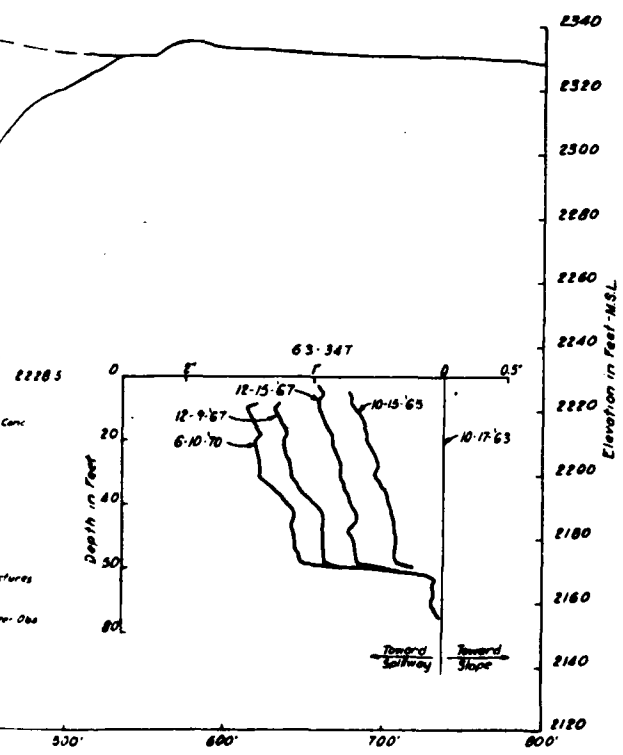
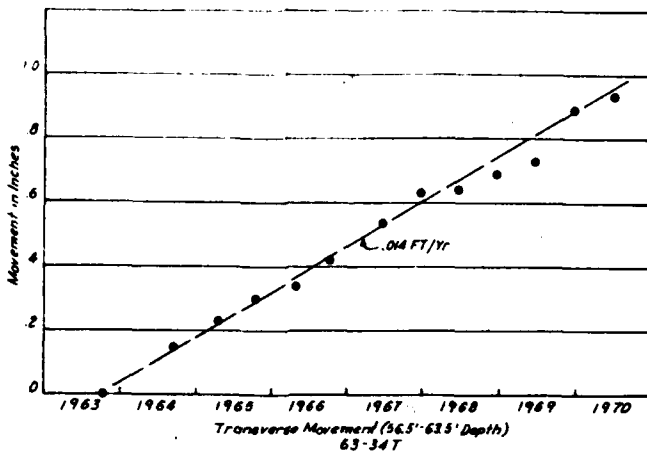
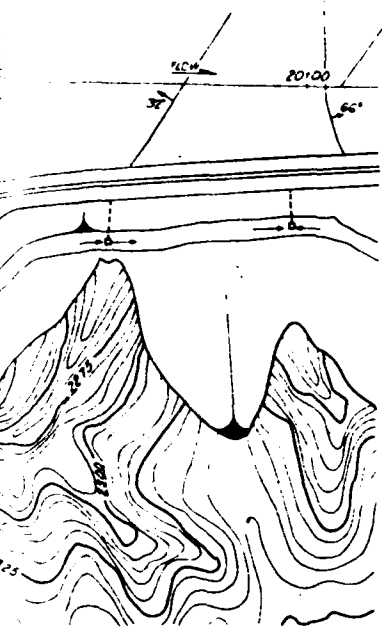


PLAN
SCALE: 1 INCH = 100 FEET



SECTION

STA 13+00
SCALE: VERT. 1 INCH = 20 FEET
HORIZ. 1 INCH = 40 FEET



LEGEND:

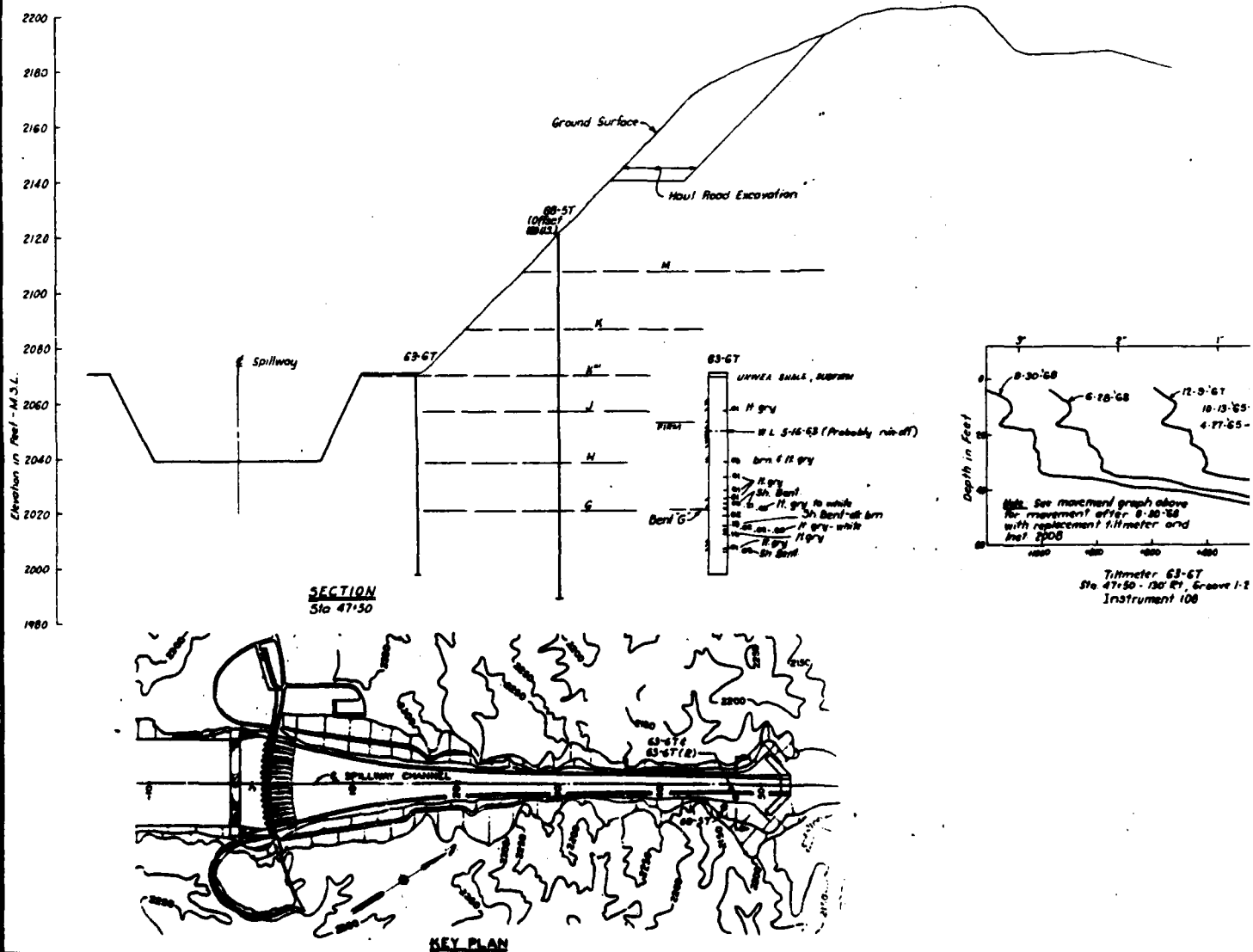
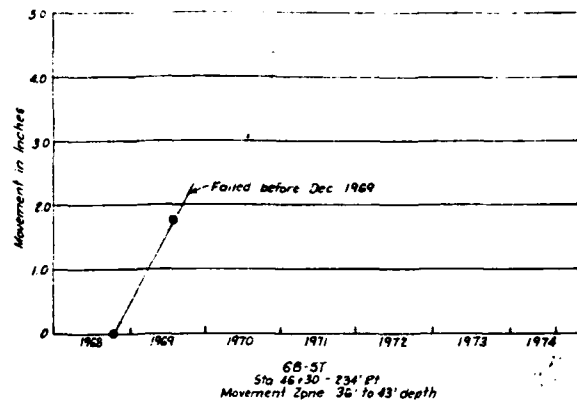
- 65-1 RILE NUMBER
- Asphalt & Gravel or Weathered Shale
- Bentonite Slickensides
- Joint
- Lost Core
- Corrections

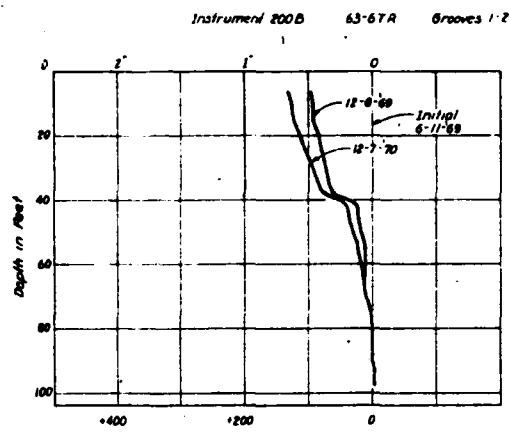
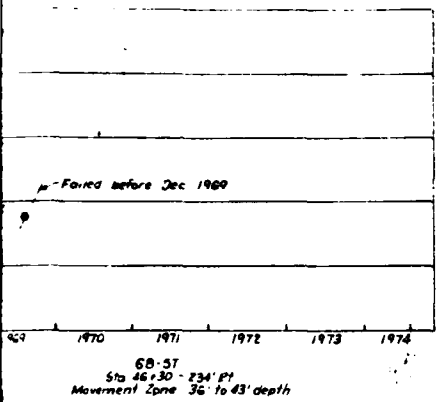
* No. indicates thickness in feet.



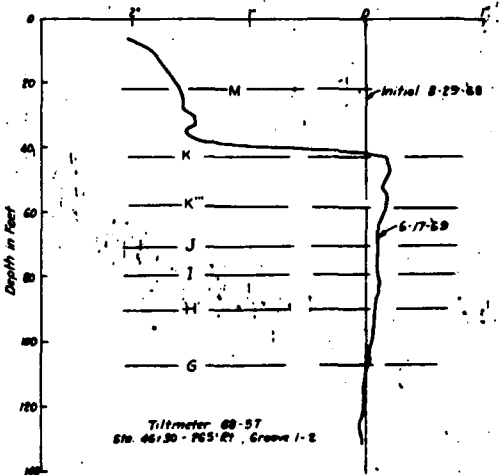
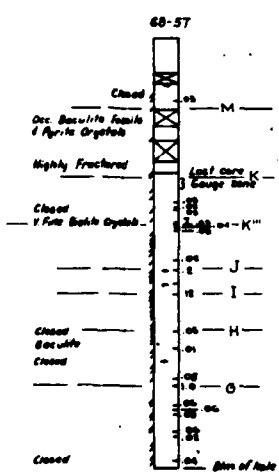
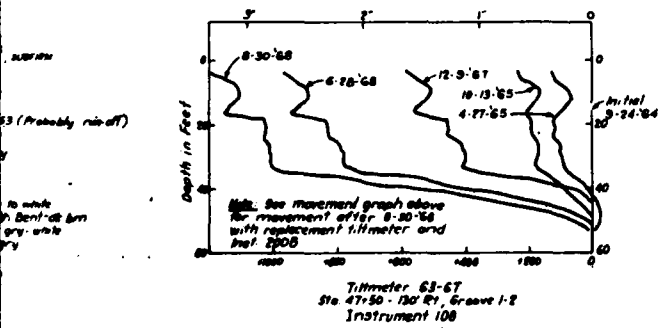
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA	
MISSOURI RIVER FORT PECK DAM AND RESERVOIR SPILLWAY REHABILITATION TILTMETER OBSERVATIONS STATION 13+00	
DESIGNED BY: C.V.J.	DATE: SEPT 1968
DRAWN BY: L.J.L.	CHKD BY: [Signature]
TRACED BY: [Signature]	APP'D BY: [Signature]
CHECKED BY: C.V.J.	DATE: [Blank]
DATE: 12-15-67	DATE: [Blank]
DATE: 6-10-70	DATE: [Blank]
DATE: 12-15-67	DATE: [Blank]
DATE: 10-15-65	DATE: [Blank]
DATE: 10-17-63	DATE: [Blank]

THIS PLAN ACCOMPANIES CONTRACT NO. DA-20-000-04
REVISION NO. 1

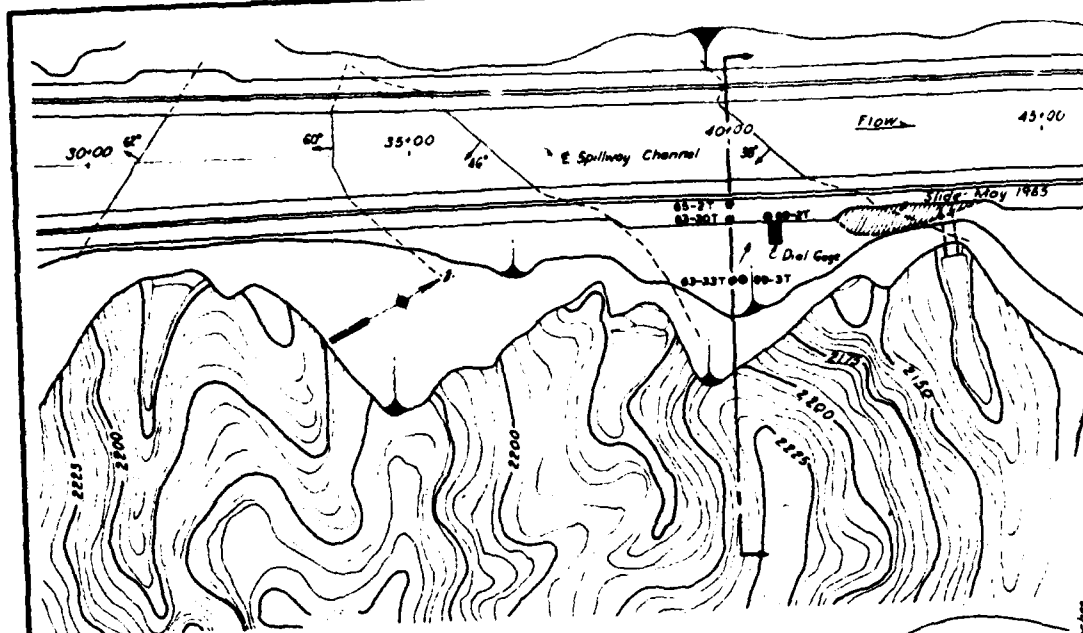




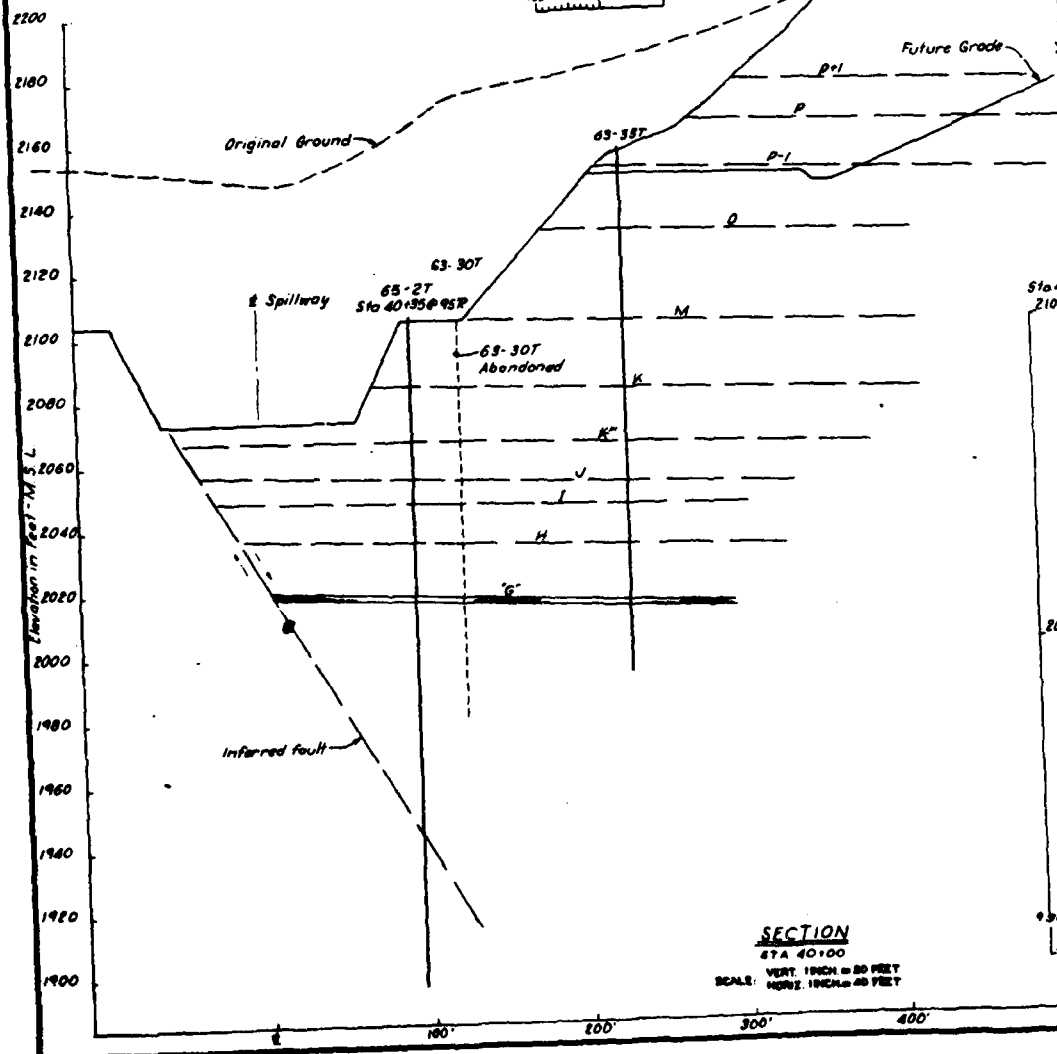
Tiltmeter 63-67 Replacement
Sta 47+60 - 130' Rt.; Groove 1-2
Instrument 200B



DATE		DESCRIPTION		MADE	APPROV
DIVISION					
U. S. ARMY ENGINEER DISTRICT, BHAMA					
GROUP OF ENGINEERS					
BHAMA, NEBRASKA					
DESIGNED BY: C. A.		MISSOURI RIVER			
DRAWN BY: L. J. L.		FORT PECK LAKE, MONTANA			
CHECKED BY: C. A.		TILTMETER OBSERVATIONS			
REVIEWED BY: C. A.		STA 46+30, 47+60 AND 47+80			
PROJECT		APPROVED		DATE	
NEW PROJECT'S NAME		NEW PROJECT'S NAME		DATE	
PROJECT		PROJECT		DATE	



PLAN
SCALE 1 INCH = 100 FEET



SECTION

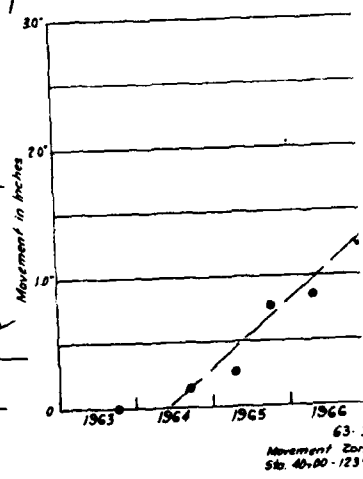
STA 40+00

VERT. 1 INCH = 20 FEET
HORIZ. 1 INCH = 40 FEET

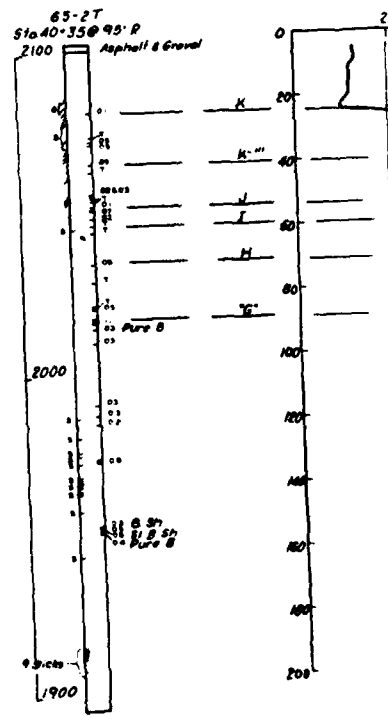
LEGEND:

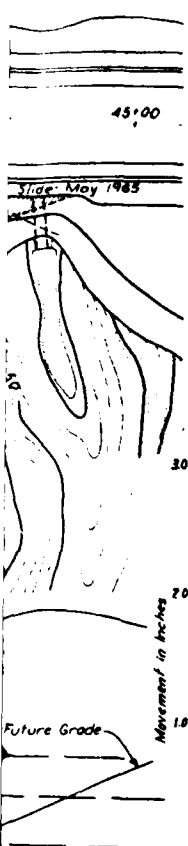
- 65-1 HOLE NUMBER
- Asphalt & Gravel
- Weathered Shale
- Bedrock to Slickensides
- Joint
- Lost Core
- Concretions

No. indicates thickness in feet.



63-1
Movement 20"
Sta. 40+00 - 123'

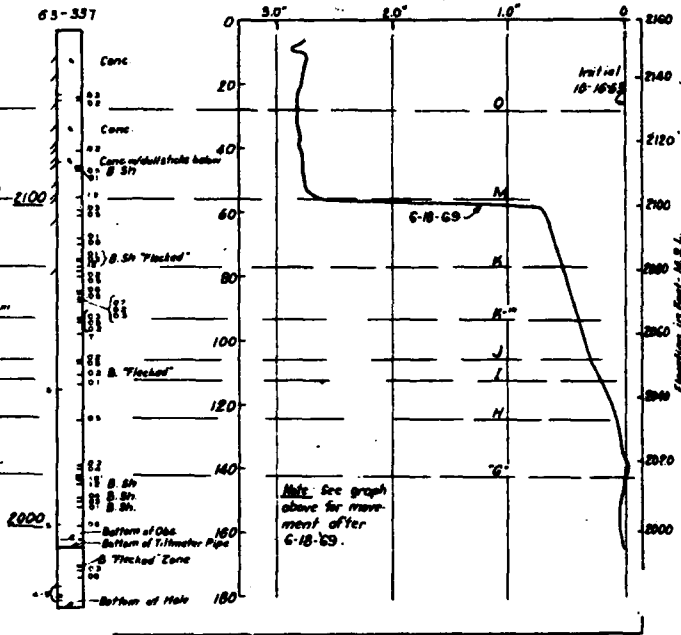
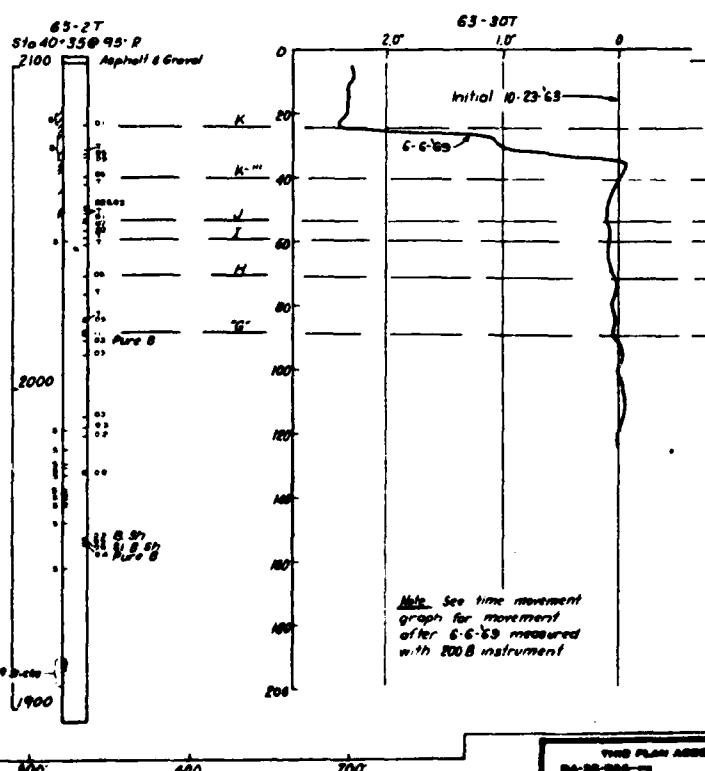
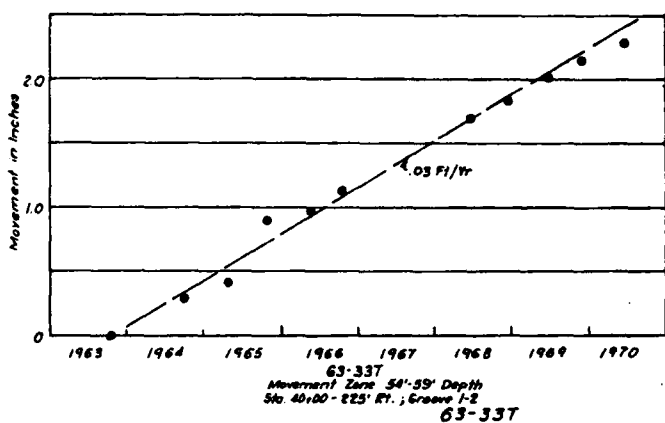
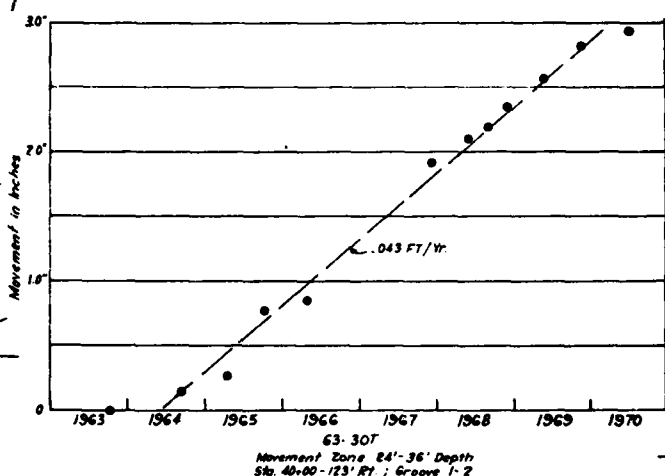
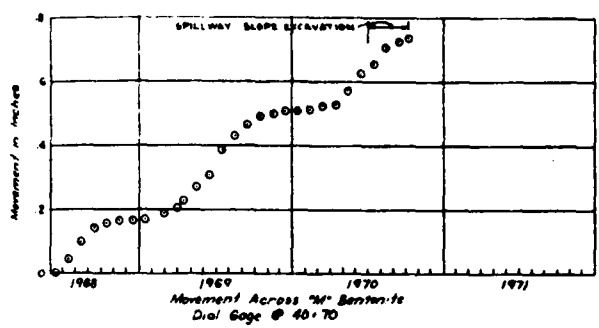




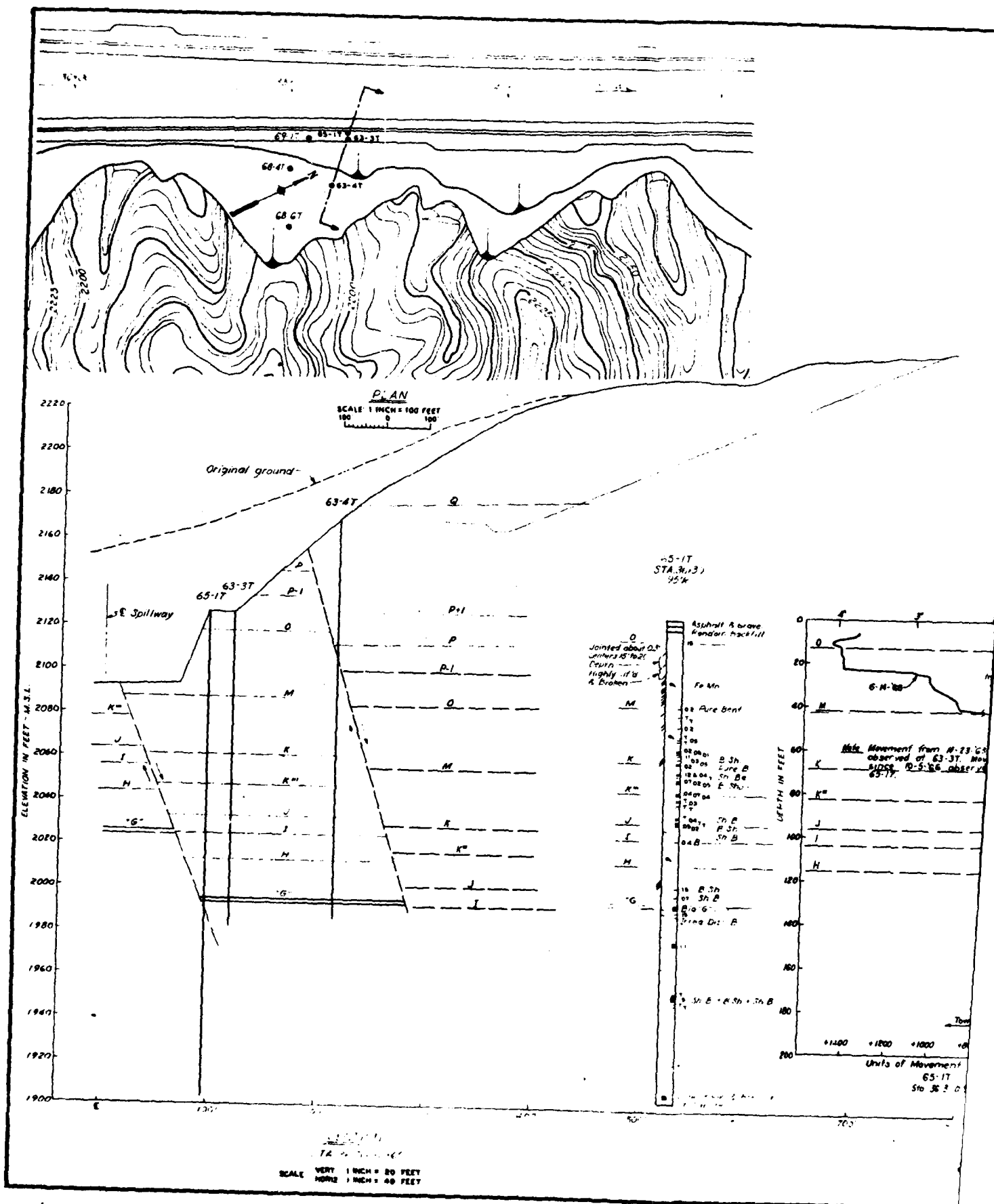
LEGEND:

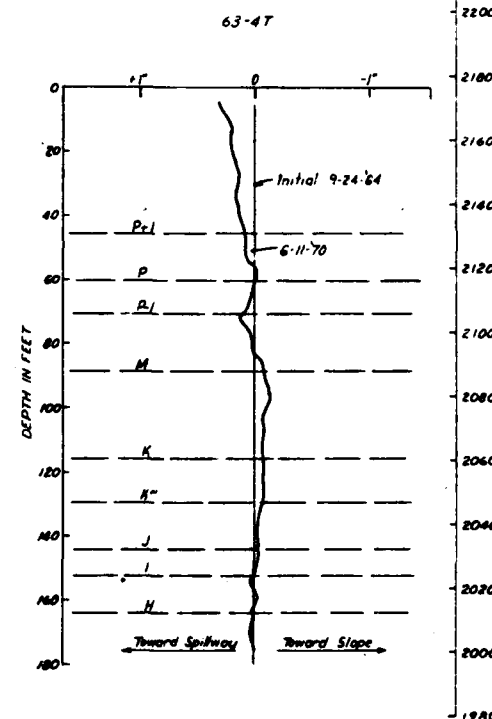
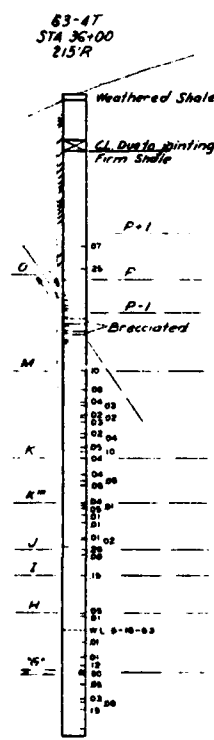
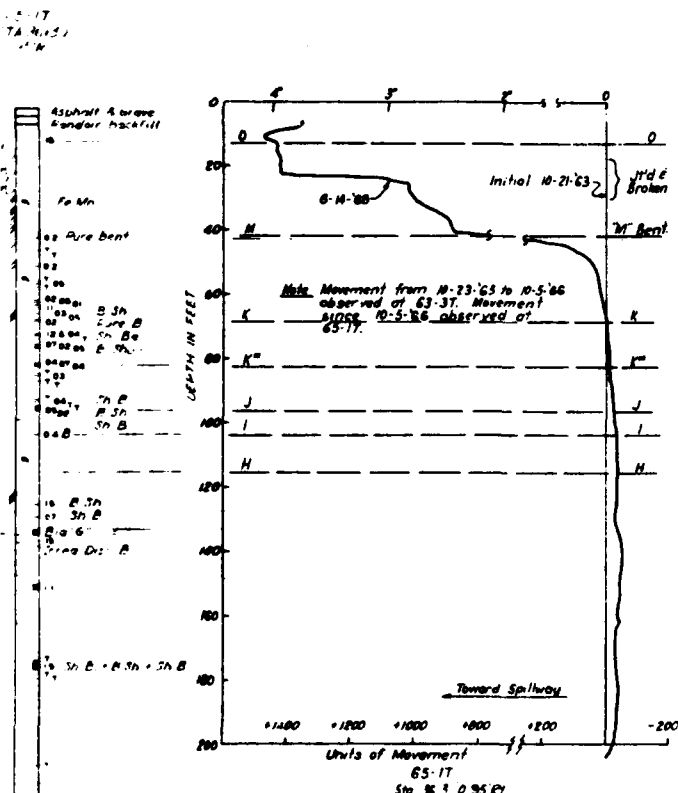
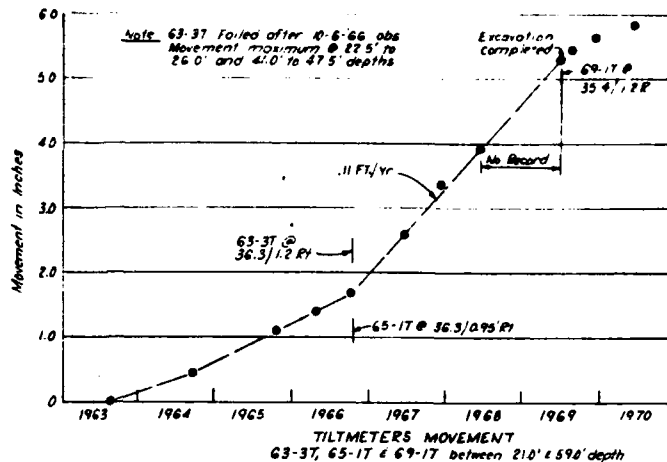
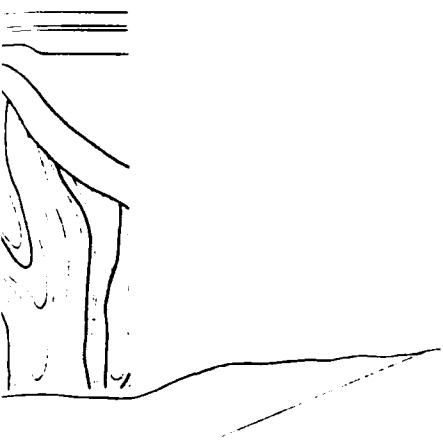
65-1
 Asphalt & Gravel or
 Weathered Shale
 Bentonite
 Slickensides
 Joint
 Lost Core
 Concretions

No. indicates thickness
 in feet.



U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA	
MISSOURI RIVER FORT PECK DAM AND RESERVOIR SPILLWAY REHABILITATION TILTMETER OBSERVATIONS STATION 40+00 AND DIAL GAGE AT STA. 40+70	
DESIGNED BY: S. J. L.	DATE: SEPT. 1966
CHECKED BY: L. J. L.	DATE: SEPT. 1966
DESIGNED BY: S. J. L.	DATE: SEPT. 1966
CHECKED BY: L. J. L.	DATE: SEPT. 1966
DESIGNED BY: S. J. L.	DATE: SEPT. 1966
CHECKED BY: L. J. L.	DATE: SEPT. 1966



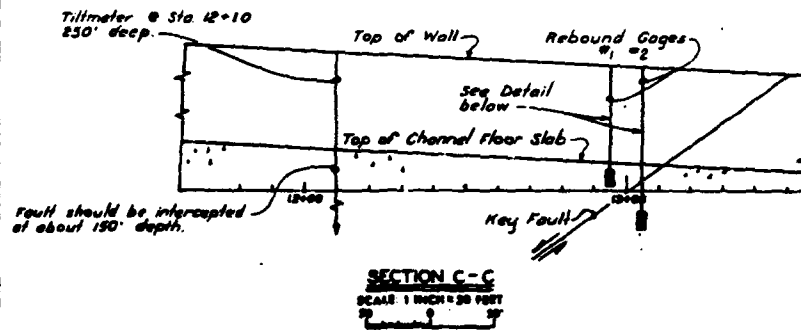
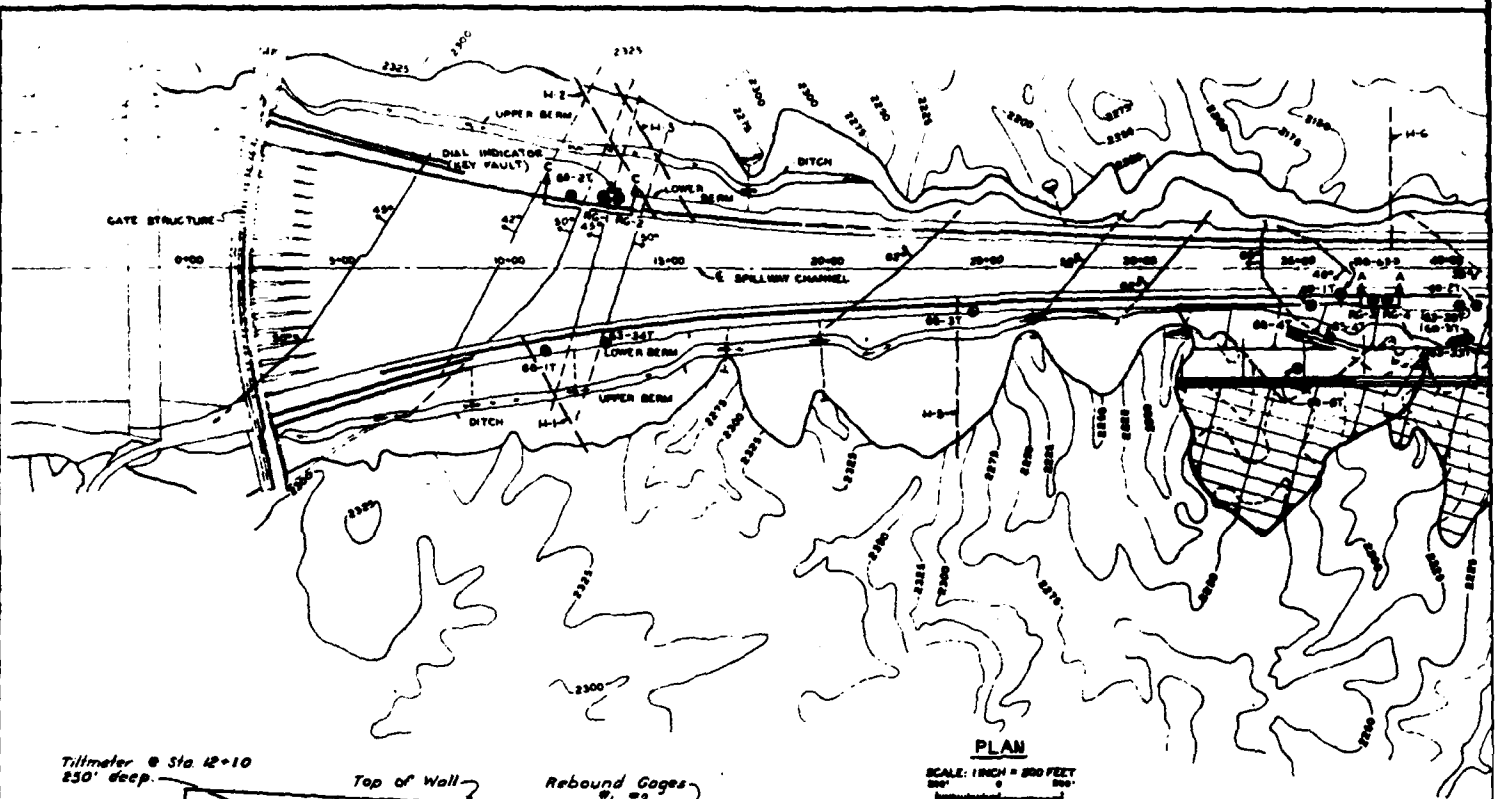


DATE	DESCRIPTION	DATE	APPROVED
REVISIONS			
U. S. ARMY ENGINEER DISTRICT, DHAHA CORPS OF ENGINEERS DHAHA, NEBRASKA			
DESIGNED BY: L. J. L.		MISSOURI RIVER	
CHECKED BY: L. J. L.		FORT PECK DAM AND RESERVOIR	
DRAWN BY: C. W. A.		SPILLWAY REHABILITATION	
CHECKED BY: C. W. A.		TILTMETER OBSERVATIONS	
APPROVED BY: L. J. L.		DIAGONAL - STA 36+00 TO 36+60	
APPROVED	DATE	APPROVED	DATE
APPROVED	SEPT 1968	APPROVED	SEPT 1968

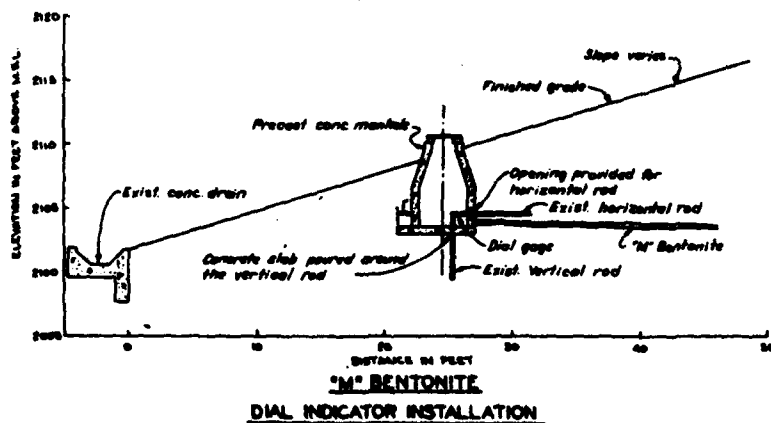
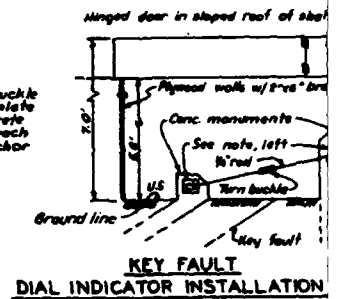


THIS PLAN ACCOMPANIES CONTRACT NO.
DA-55-006-001
MODIFICATION NO.

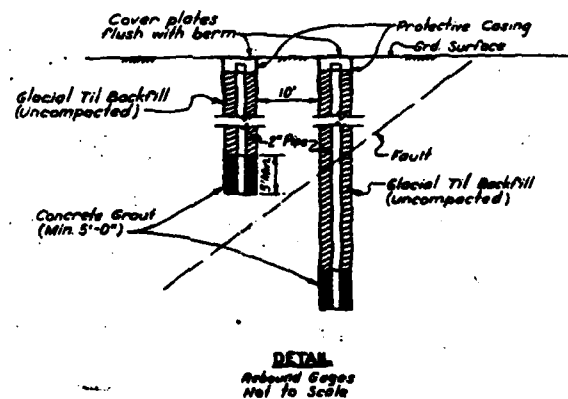
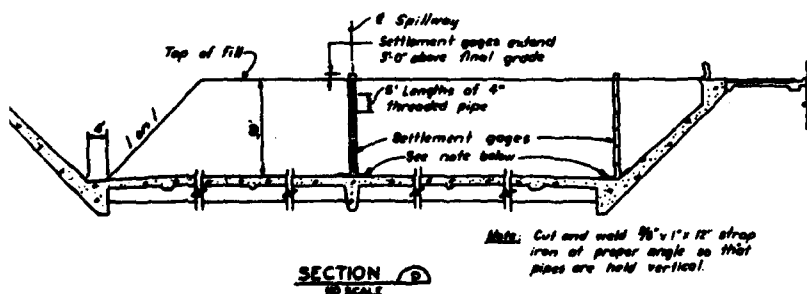
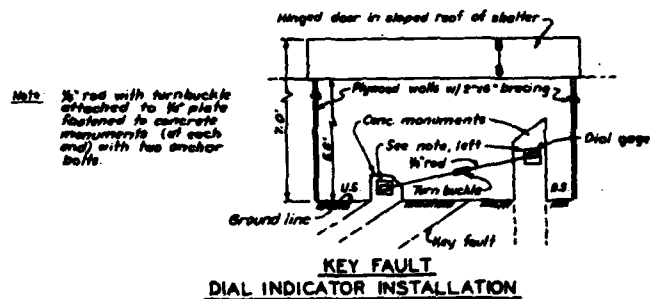
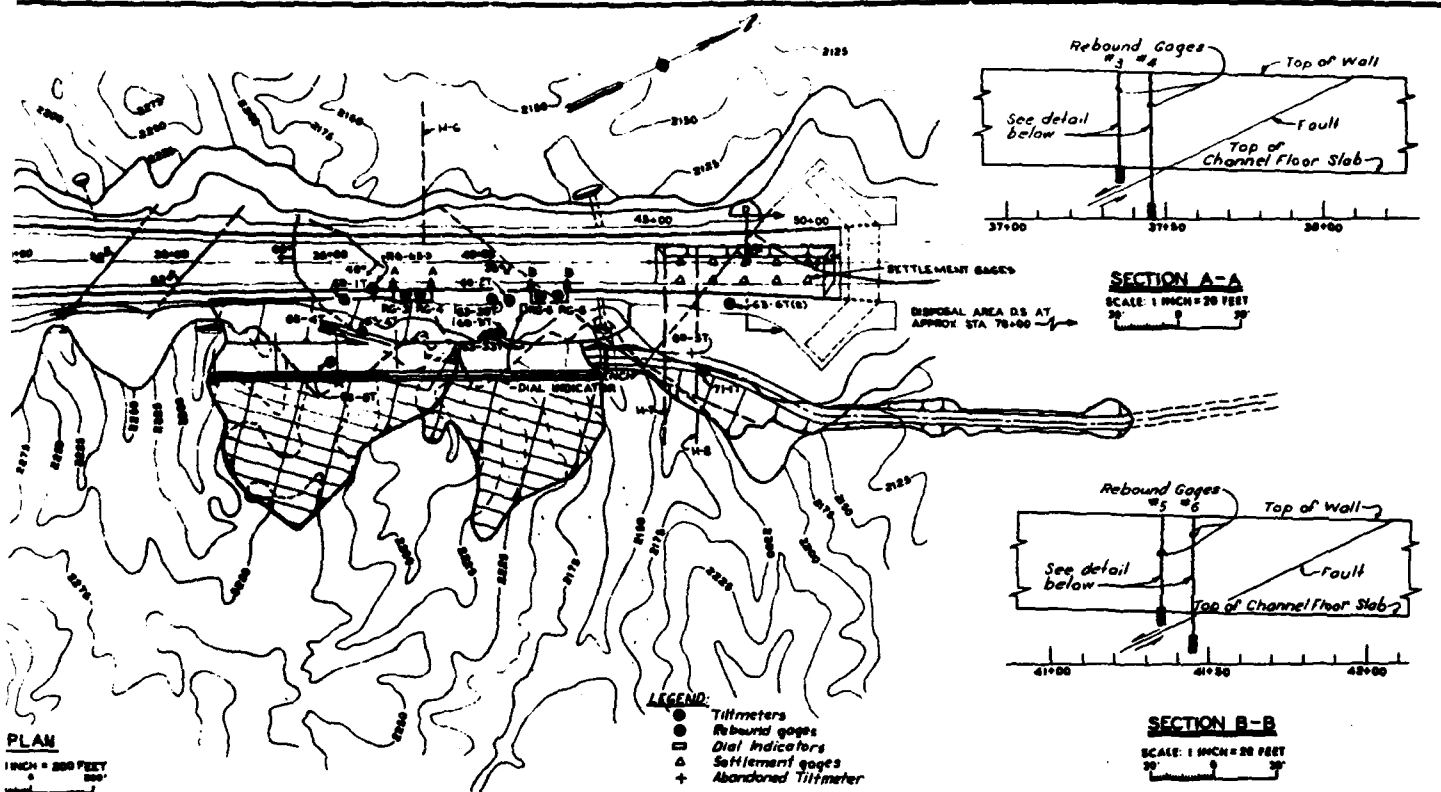
2



Note: 1/2" rod with turnbuckle attached to 1/2" plate fastened to concrete monuments (at each end) with two anchor bolts.



Note: "M" Bentonite (sampling trench) dial gage installation May 1968 in exterior mudstone quarry and weather proof shelter. Reinstallation during spillway slope restoration stage II in conc. mantle Oct 1970 (see above).



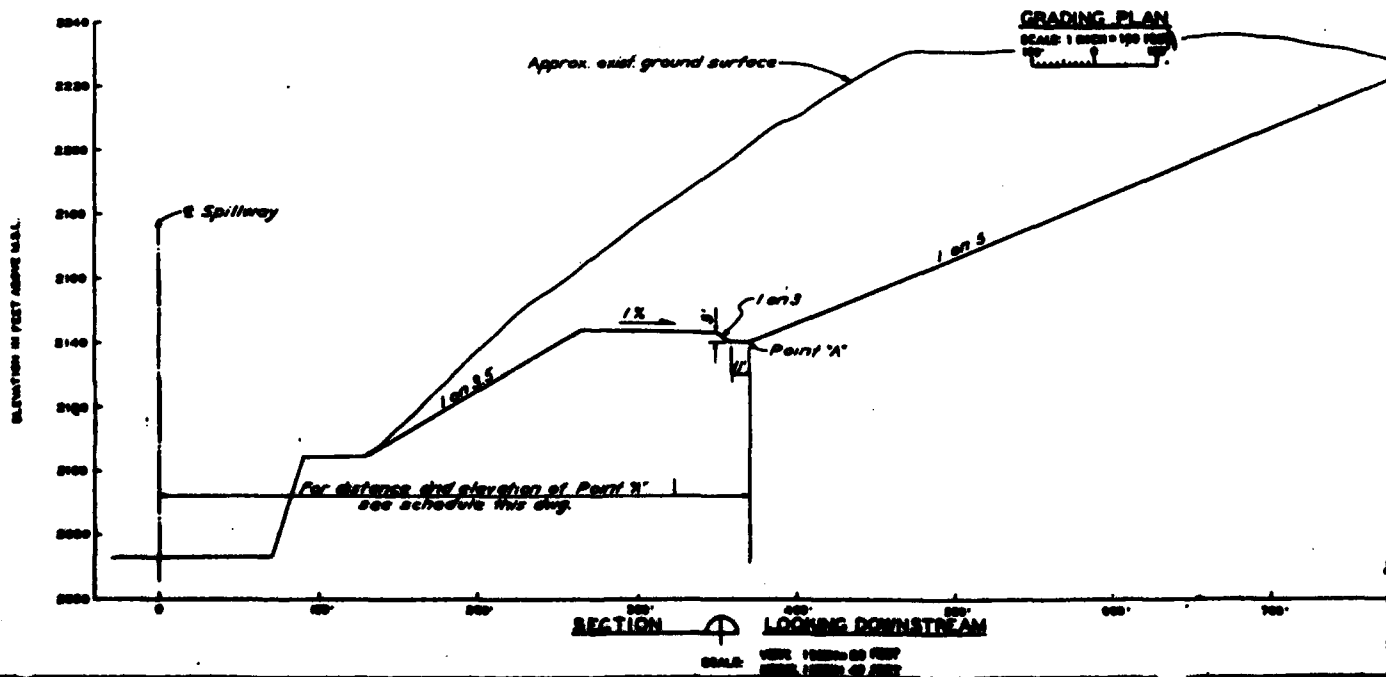
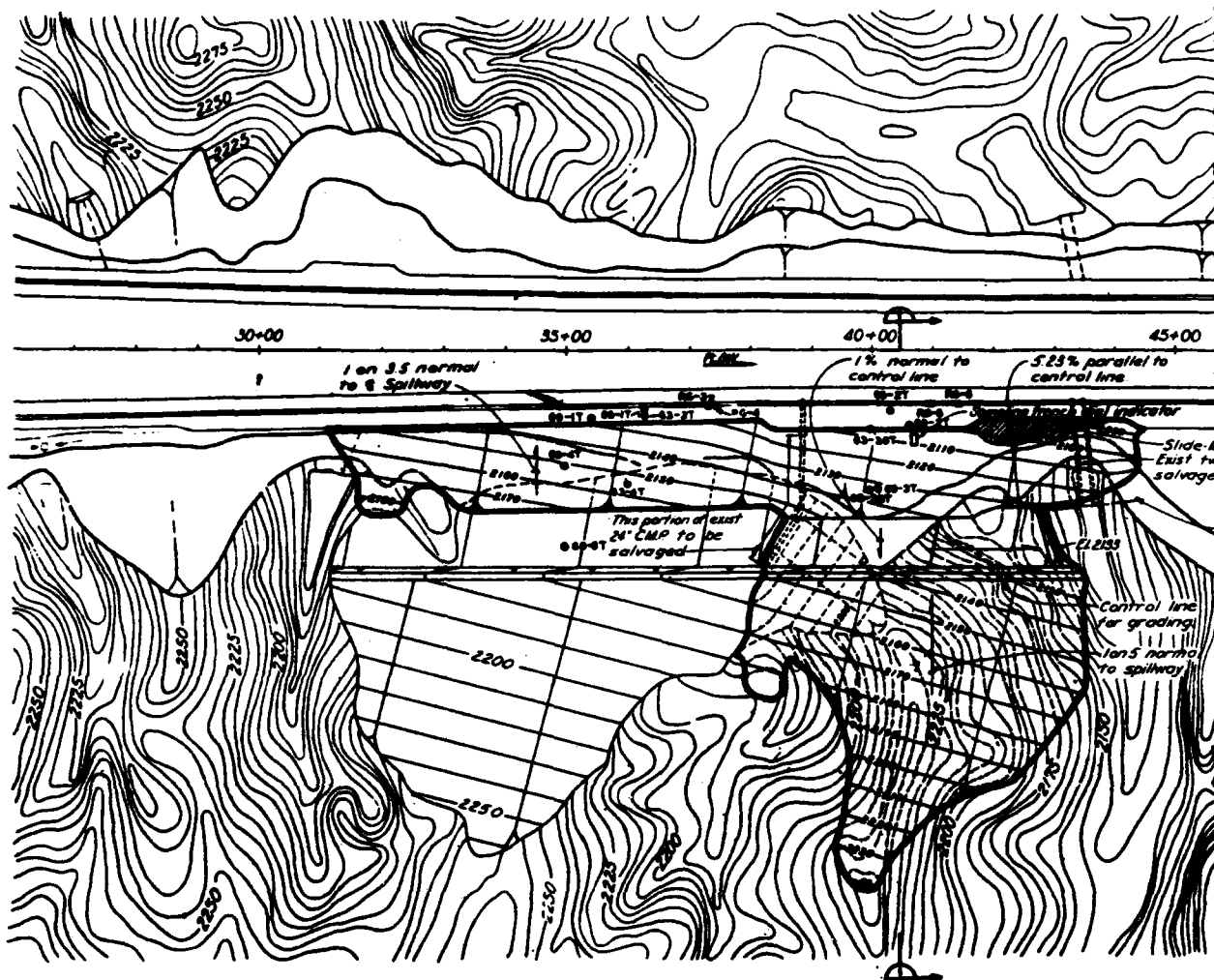
THIS PLAN ASSUMES CONTRACT NO. 100-1-100-100

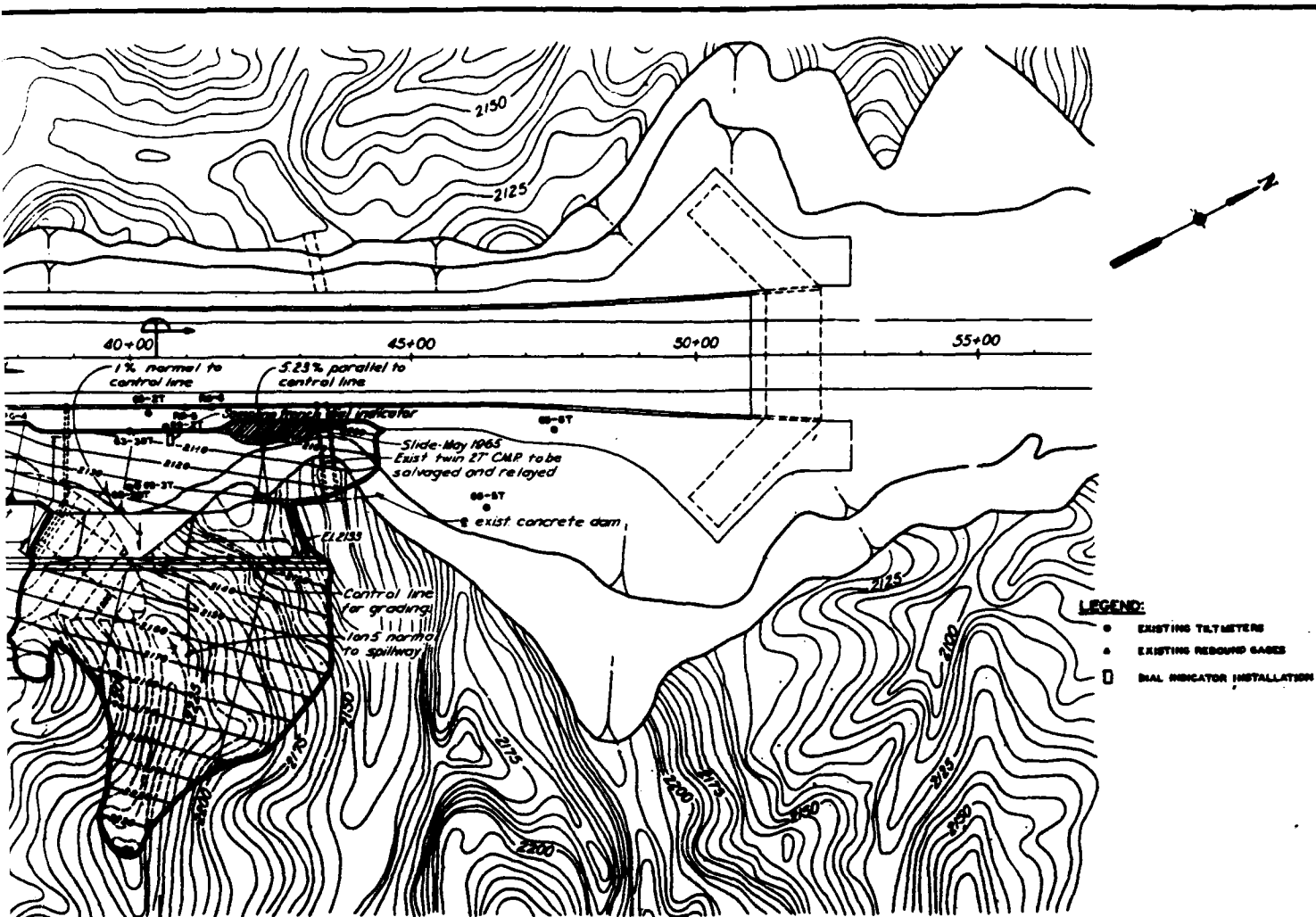
CONSTRUCTION FOUNDATION REPORT

PLATE 144

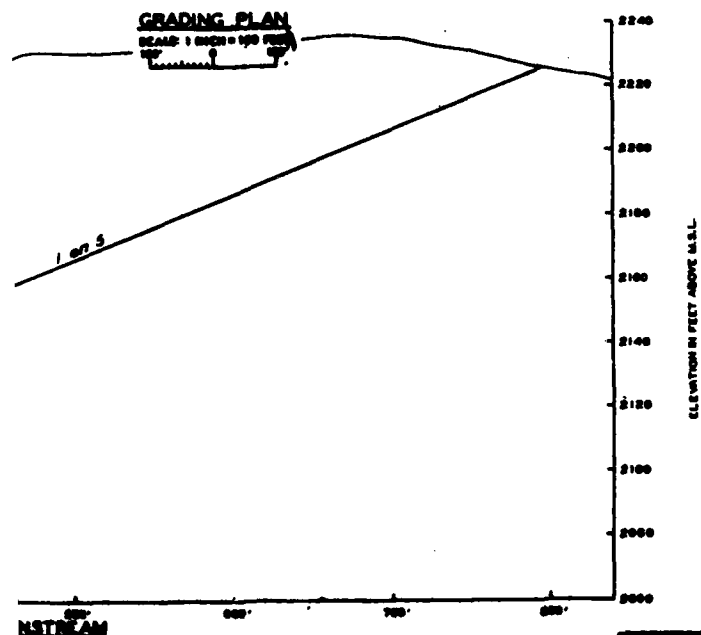
2

U. S. ARMY ENGINEER DISTRICT, OMAHA GROUP OF ENGINEERS CHICAGO, ILLINOIS	
DESIGNED BY: A.E.A.	CHIEF OF DIVISION: J.E.A.
DRAWN BY: J.E.A.	CHIEF OF SECTION: J.E.A.
CHECKED BY: J.E.A.	CHIEF OF SECTION: J.E.A.
APPROVED BY: J.E.A.	CHIEF OF SECTION: J.E.A.
FORT PECK DAM AND RESERVOIR SPILLWAY MOVEMENT INSTRUMENTATION	
DATE: 10-1-50	SCALE: 1 INCH = 20 FEET
BY: J.E.A.	DATE: 10-1-50
BY: J.E.A.	DATE: 10-1-50
BY: J.E.A.	DATE: 10-1-50





GRADING PLAN
SCALE: 1" = 100' HORIZ.
1" = 10' VERT.

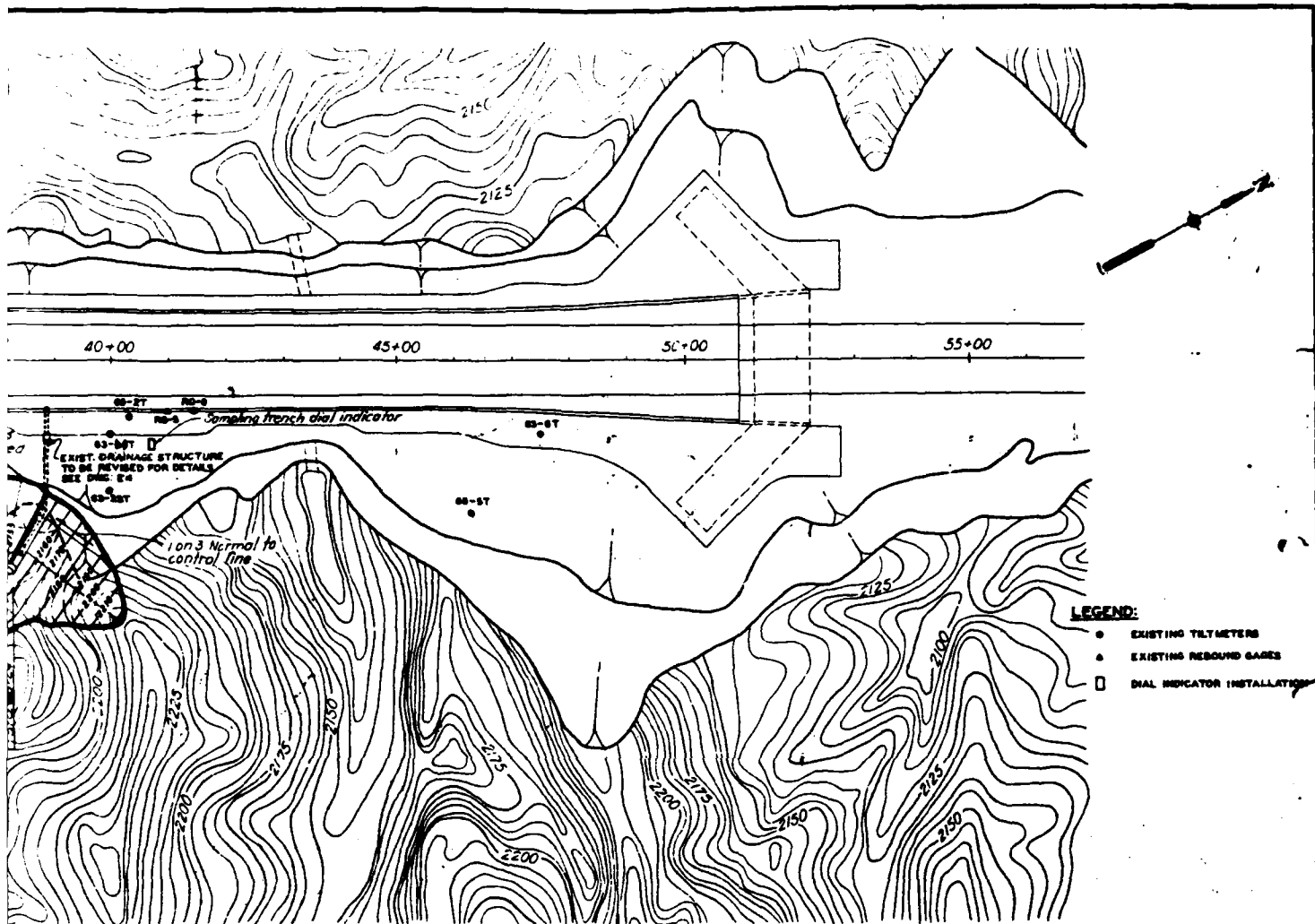


ALIGNMENT AND ELEVATION SCHEDULE		
STATION	DISTANCE "W"	ELEVATION "W"
38+00	370.00'	2147.18
40+00	370.00'	2141.81
41+00	370.00'	2136.70
42+00	370.00'	2131.47
43+00	370.00'	2126.24

THIS DRAWING HAS BEEN REDUCED TO
THREE-EIGHTHS THE ORIGINAL SCALE.

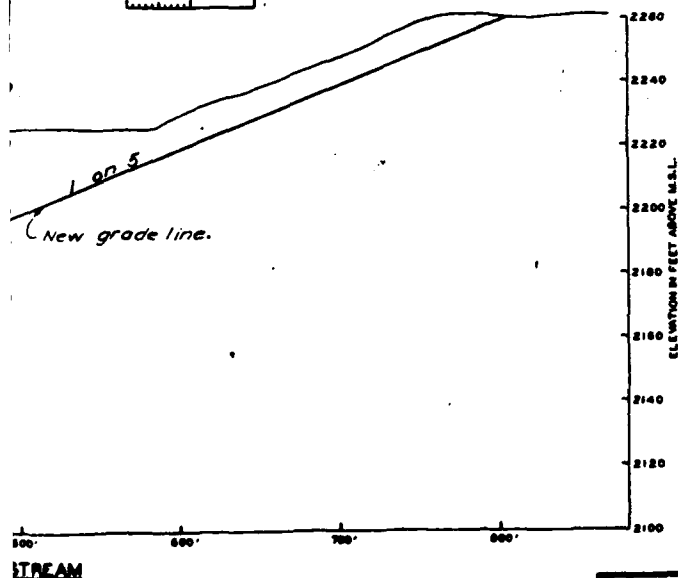


U. S. ARMY ENGINEER DISTRICT, CHAGUA GROUP OF ENGINEERS CHAGUA, MICHIGAN	
PORT PECK DAM AND RESERVOIR SPILLWAY SLOPE EROSION STAGE 22 GRADING PLAN AND SECTION	
DESIGNED BY CHECKED BY APPROVED BY DATE	DATE BY FOR
B. P. Boudreau	
MFP-113	



GRADING PLAN

SCALE: 1 INCH = 100 FEET
100'

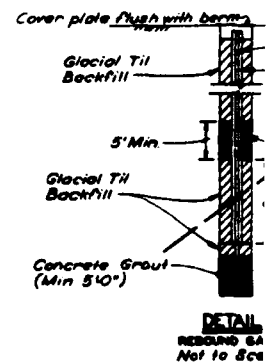
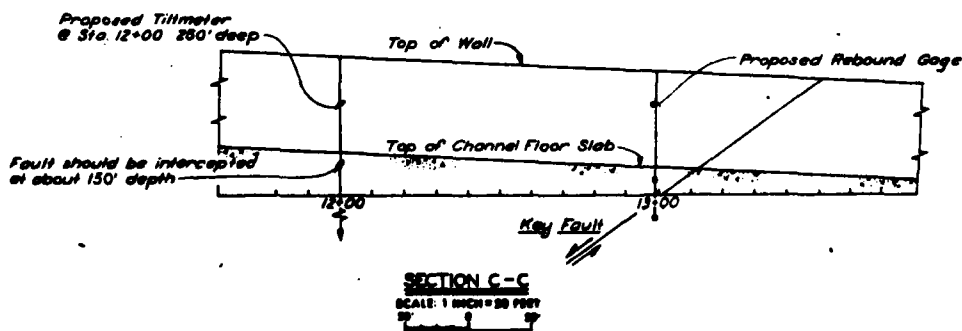
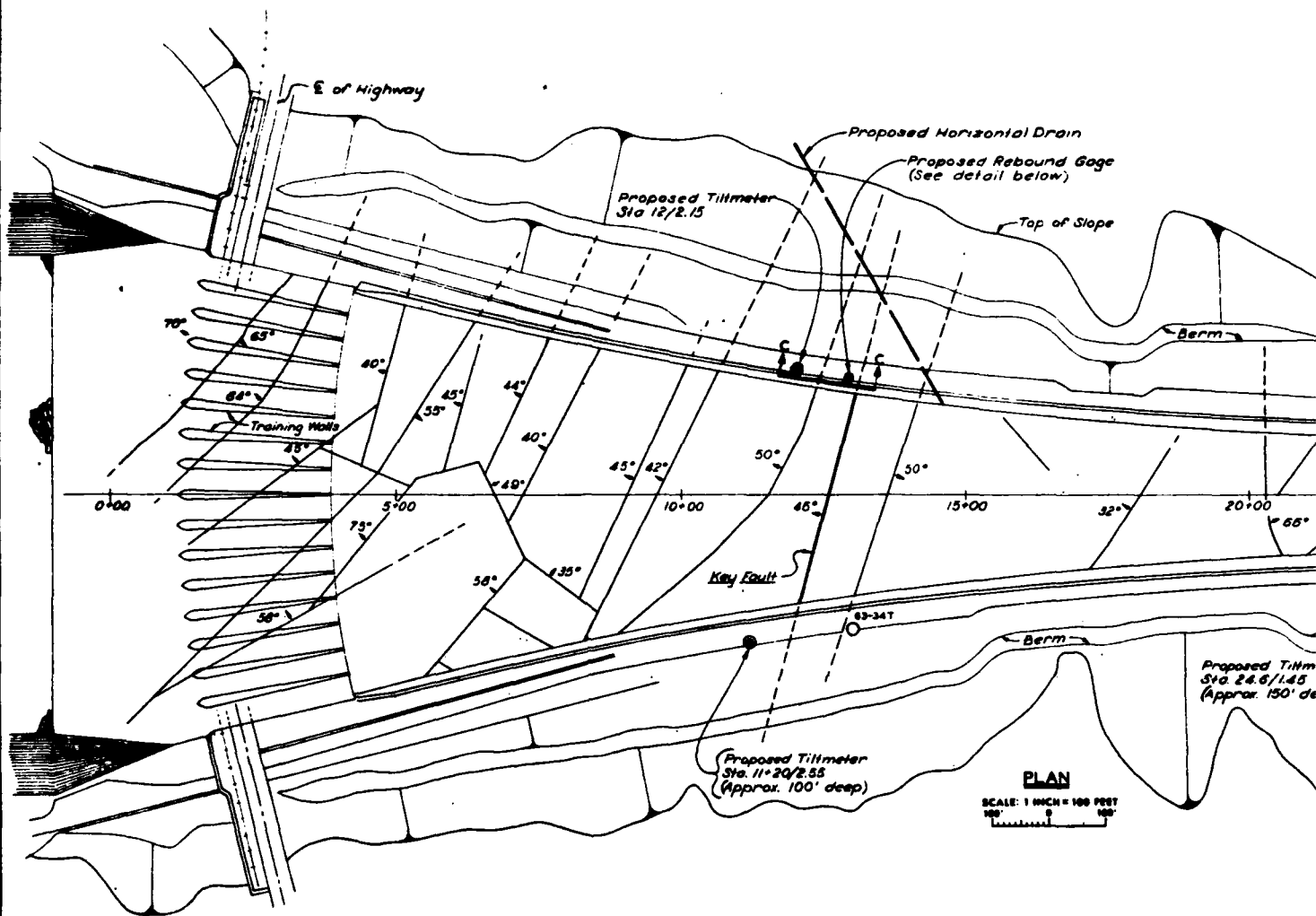


ALIGNMENT AND ELEVATION SCHEDULE		
STATION	DISTANCE "W"	ELEVATION "W"
32+00	370.00'	2183.77
33+00	370.00'	2178.34
34+00	370.00'	2173.57
35+00	370.00'	2168.08
36+00	370.00'	2162.85
37+00	370.00'	2157.62
38+00	370.00'	2152.39

SECTION NUMBER
DISTANCE NUMBER OF SHEET
SECTION NUMBER OF SHEET
SECTION IDENTIFICATION

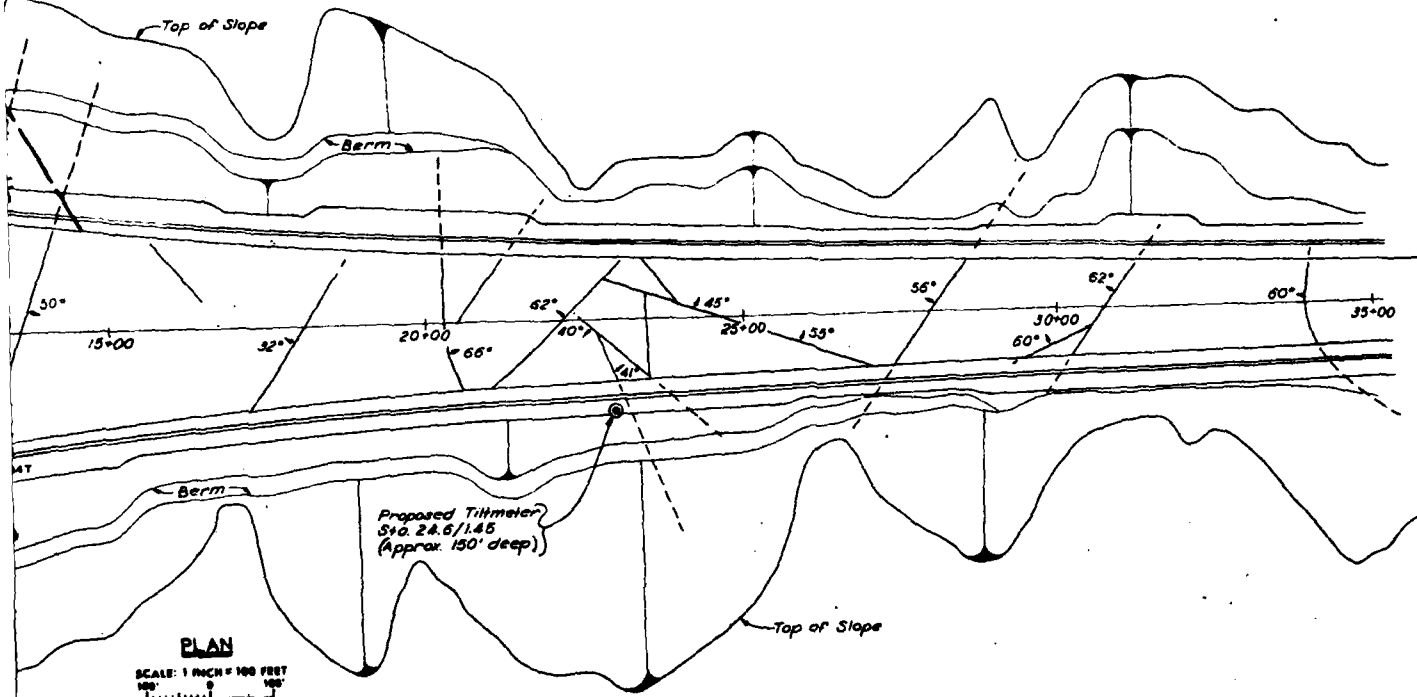


U. S. ARMY ENGINEER DISTRICT, CHICAGO GROUP OF ENGINEERS CHICAGO, ILLINOIS	
<p>FOR THE DISTRICT</p> <p>FOR THE GROUP</p> <p>DATE: JUL 1966</p> <p>PROJECT: MFP43-512</p>	



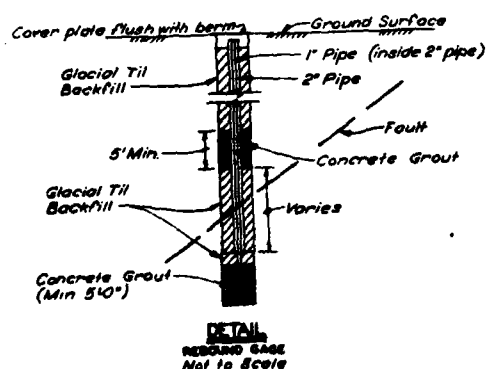
Proposed Horizontal Drain

Proposed Rebound Gage
(See detail below)



LEGEND:

- ⊙ PROPOSED TILTMETER
- EXISTING TILTMETER
- PROPOSED REBOUND GAGE



U. S. ARMY ENGINEER DISTRICT, SIOUX FALLS		DATE	APPROVED
SIOUX FALLS, S.D.		DATE	APPROVED
FORT PECK DAM AND RESERVOIR		DATE	APPROVED
SPILLWAY REHABILITATION		DATE	APPROVED
UPSTREAM HORIZONTAL DRAIN		DATE	APPROVED
AND INSTRUMENTATION		DATE	APPROVED
DESIGNED BY: C. H. A.		DATE: SEPT 1960	
CHECKED BY: C. H. A.		DATE: SEPT 1960	
APPROVED BY: C. H. A.		DATE: SEPT 1960	
DRAWN BY: C. H. A.		DATE: SEPT 1960	

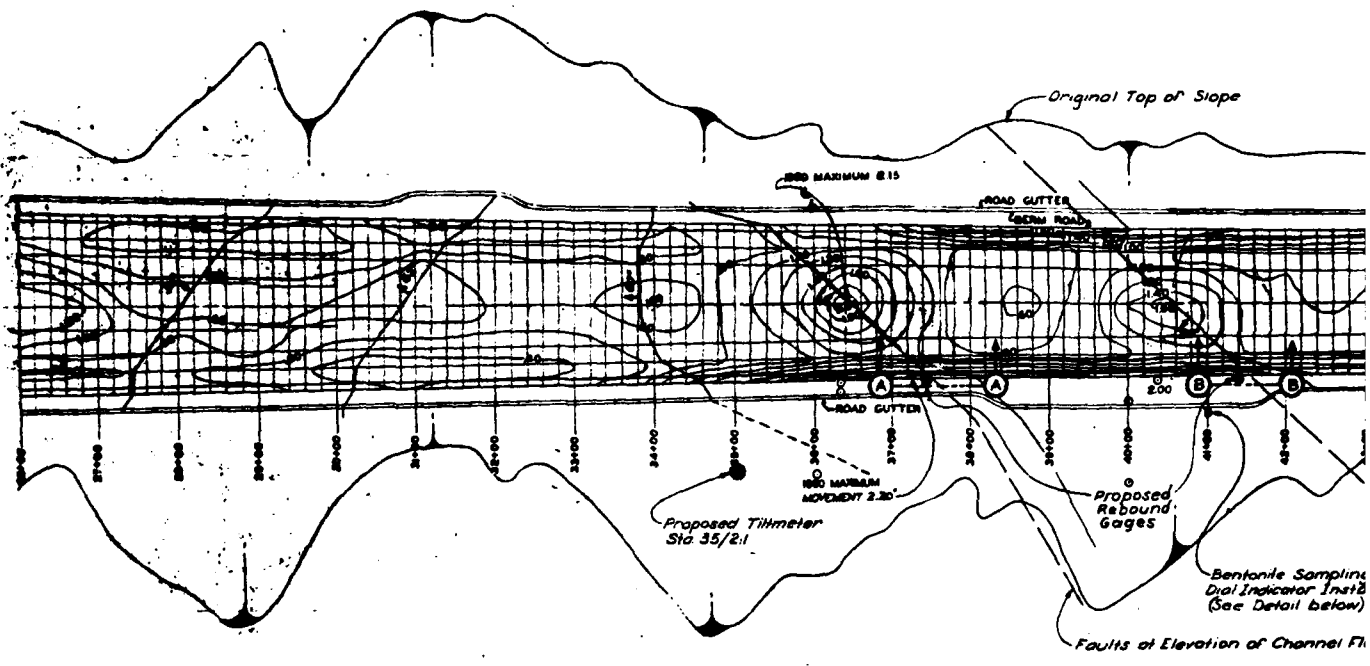


THIS DRAWING HAS BEEN REDUCED TO
THREE-FIFTHS THE ORIGINAL SIZE.

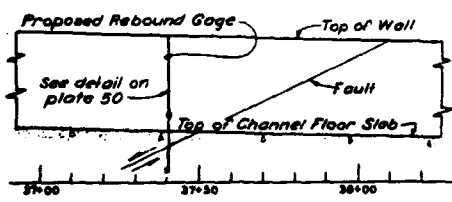
THIS PLAN ACCOMPANIES CONTRACT NO.
DA-36-000-100

CONSTRUCTION FOUNDATION REPORT

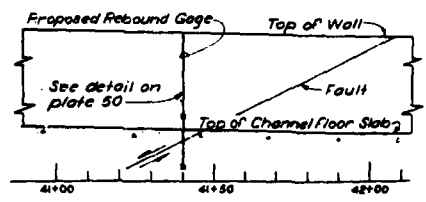
2 PLATE 107



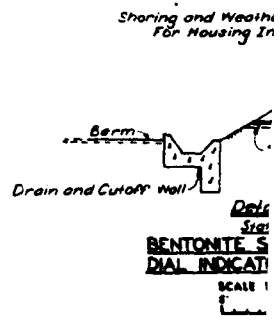
PLAN
SCALE: 1 INCH = 50 FEET

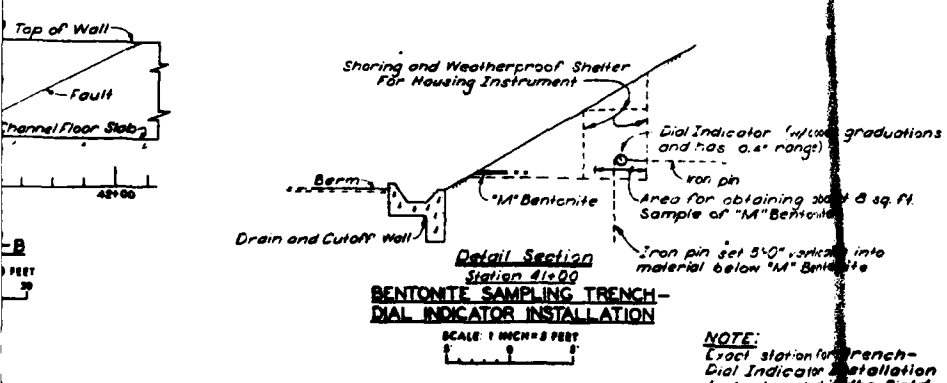
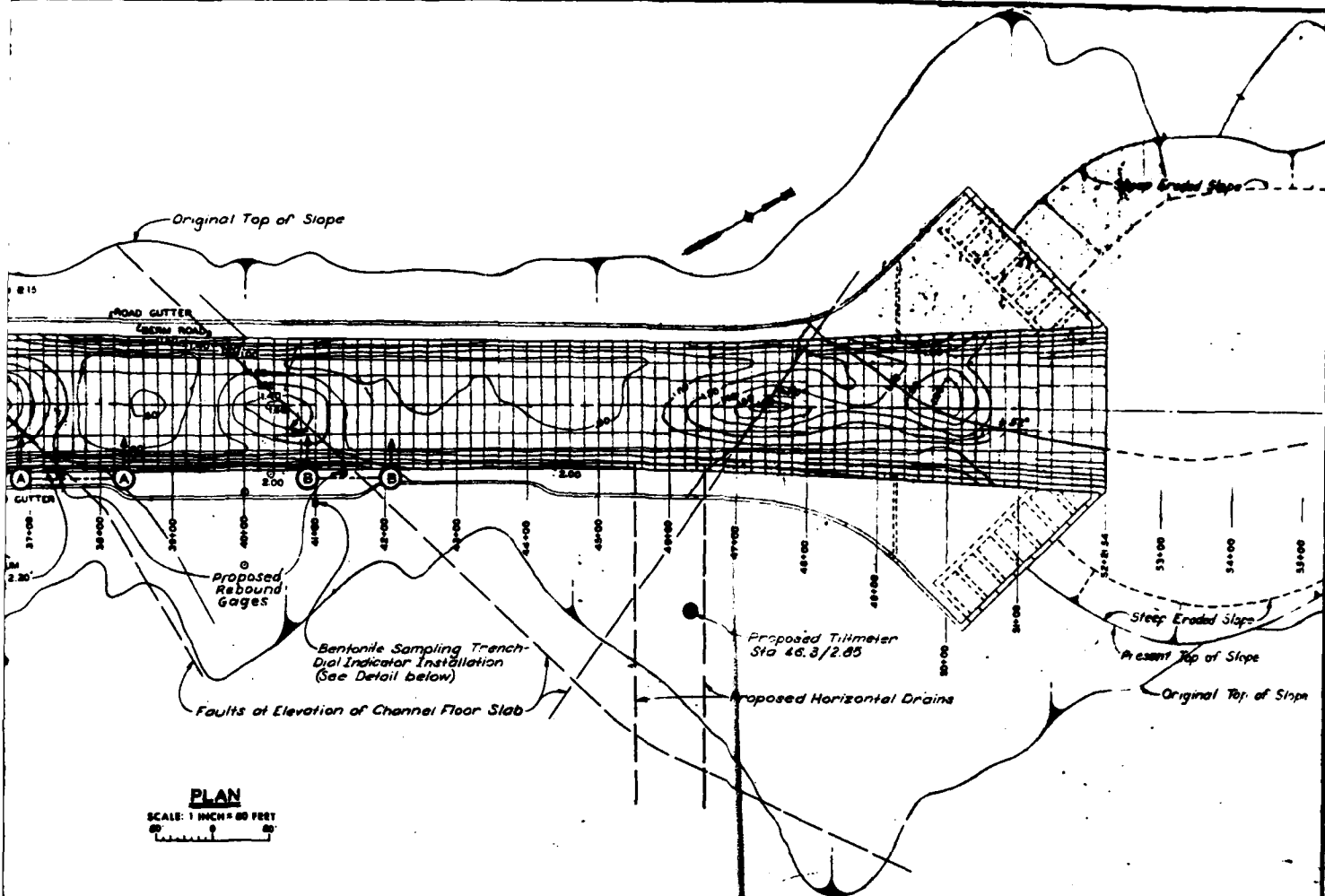


SECTION A-A
SCALE: 1 INCH = 30 FEET



SECTION B-B
SCALE: 1 INCH = 30 FEET

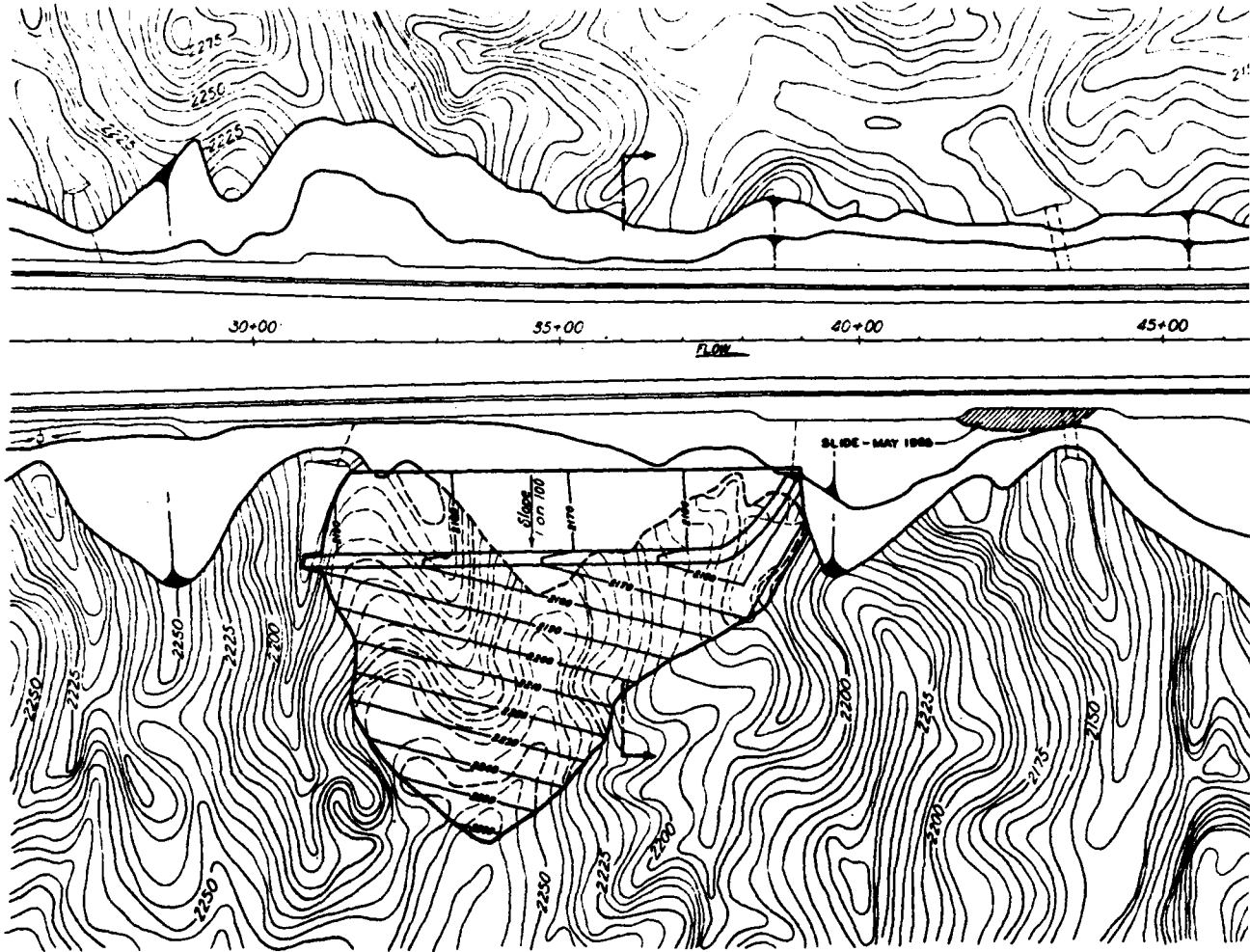




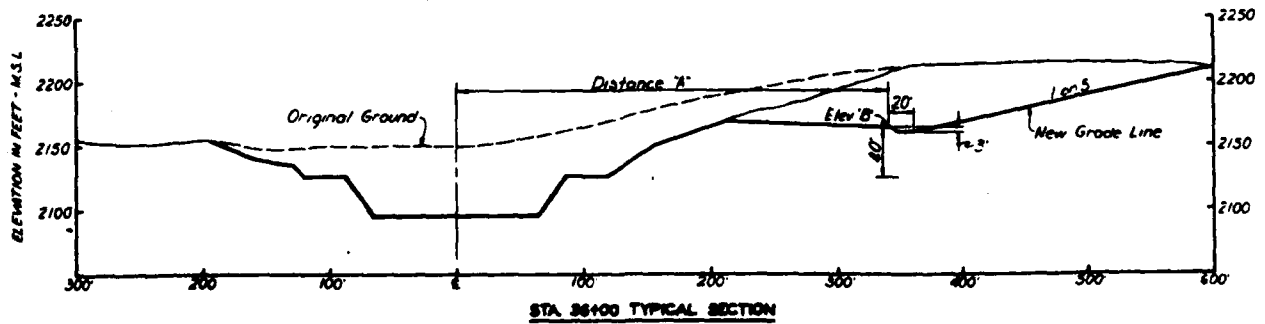
LEGEND:

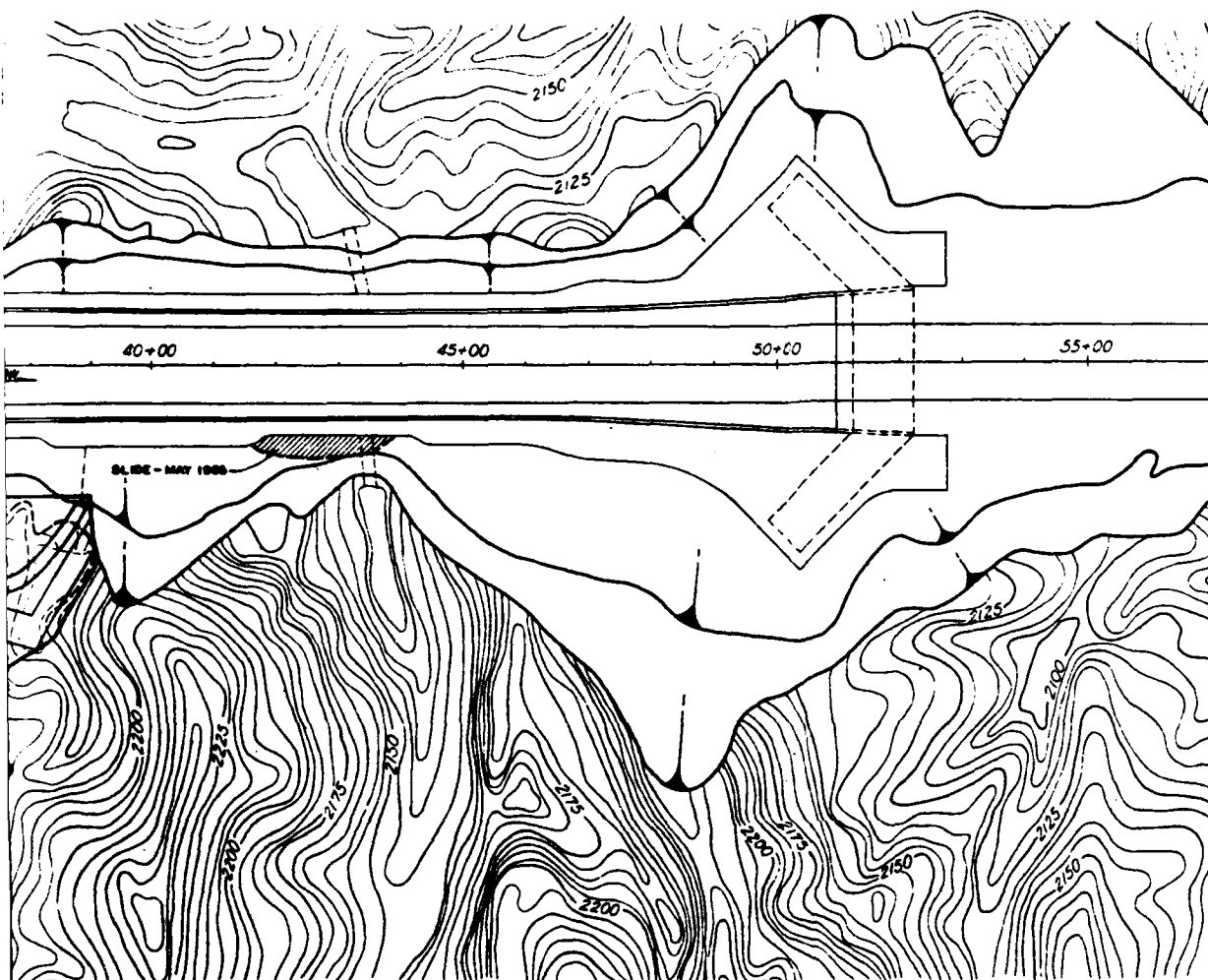
- PROPOSED TILTMETERS
- EXISTING TILTMETERS
- PROPOSED REBOUND GAGES

DESIGNED BY: C.V.J. & W.A.		DRAWN BY: R.E.R.	
CHECKED BY: R.E.R.		APPROVED BY: C.V.J.	
DATE: 10/1/50		DATE: 10/1/50	
U. S. ARMY ENGINEER DISTRICT, OMAHA DIVISION OF ENGINEERING OMAHA, NEBRASKA			
MISSOURI RIVER FORT PECK DAM AND RESERVOIR SPILLWAY REHABILITATION DOWNSIDE HORIZONTAL DRAIN AND INSTRUMENTATION			
PROJECT NO. 100-1000 DRAWING NO. 100-1000-1		DATE: 10/1/50 BY: C.V.J. & W.A.	

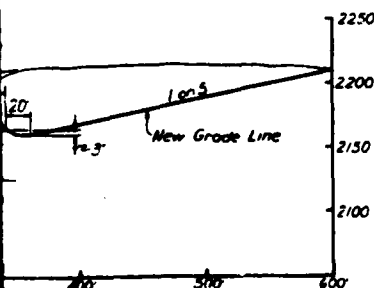


PLAN
SCALE: 1 INCH = 100 FEET





PLAN
SCALE: 1 INCH = 100 FEET



RIGHT SIDE		
STATION	DISTANCE "A"	ELEV. "P"
38+00	340.00'	2186.77
33+00	340.00'	2181.54
30+00	340.00'	2176.31
25+00	339.81'	2171.08
20+00	338.72'	2165.85
17+00	337.43'	2160.62



U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA	
MISSOURI RIVER FORT PECK DAM AND RESERVOIR SPILLWAY REHABILITATION EXPERIMENTAL GRADING PLAN STA. 31+00 TO STA. 39+00	
DESIGNED BY: C.V. GWA	DATE: SEPT 1955
CHECKED BY: RM	APPROVED BY: [Signature]
DESIGNED BY: RM	DATE: AS SHOWN
CHECKED BY: CWA	DATE: [Signature]
DESIGNED BY: [Signature]	DATE: [Signature]
CHECKED BY: [Signature]	DATE: [Signature]

THIS DRAWING HAS BEEN REDUCED TO
THREE-FIFTHS THE ORIGINAL SCALE.

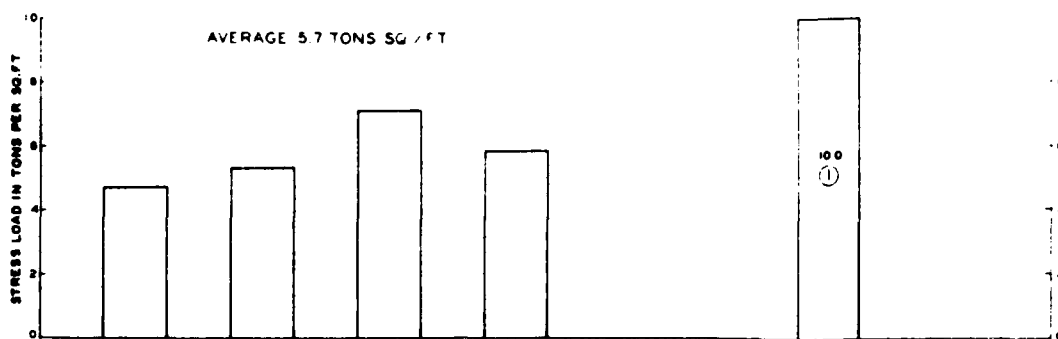
THIS PLAN ACCOMPANIES CONTRACT NO. 6A-50-500-4
CONSTRUCTION NO.

CONSTRUCTION FOUNDATION REPORT

PLATE 149

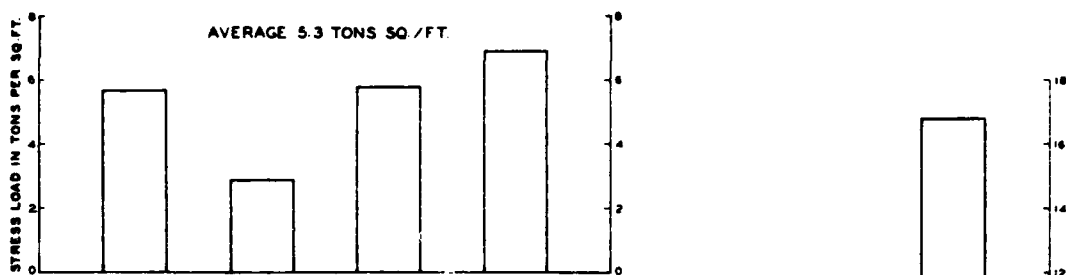
2

CORPS OF ENGINEERS



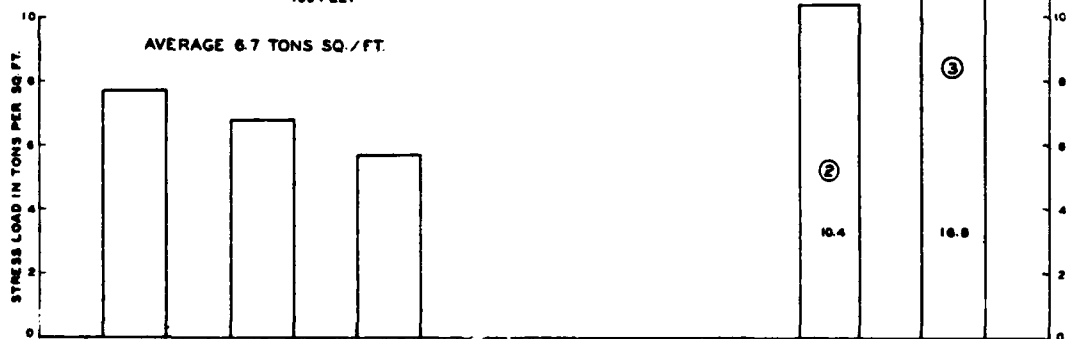
TYPICAL TENSIL

SAMPLE U-7
55 FEET

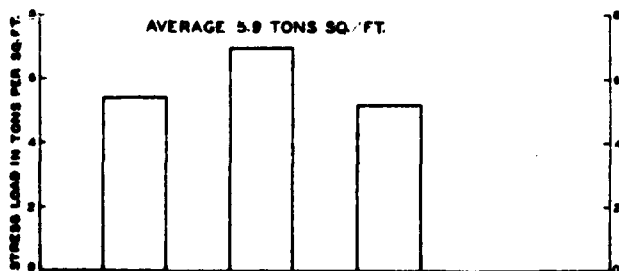


LEGEND:
① LOADED TO 1.3
THEN QUICK T
② LOADED TO 2.4
THEN QUICK T
③ LOADED TO 1.9
3.2 TONS SQ./
7 DAYS THEN

SAMPLE U-11
100 FEET



SAMPLE U-16
140 FEET

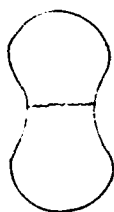
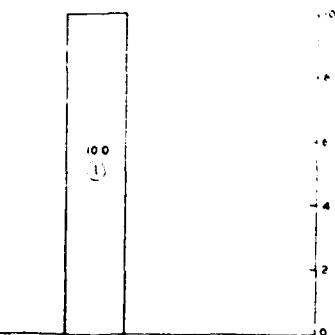


SAMPLE U-27
210 FEET

QUICK TESTS
600°/MINUTE

SPECIAL TESTS
SEE LEGEND

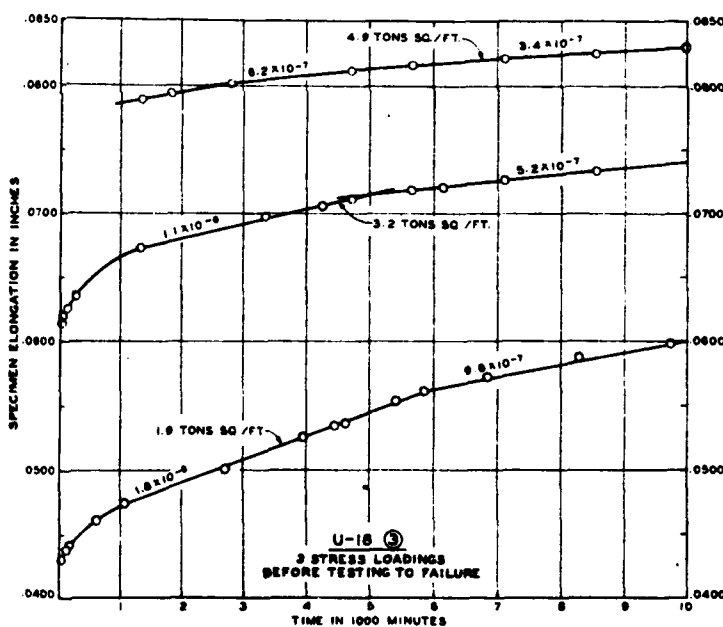
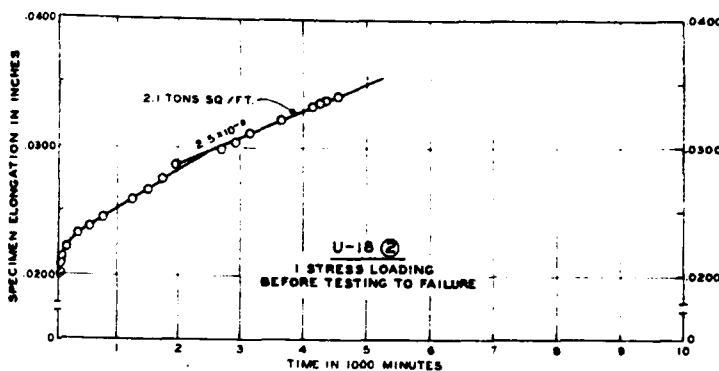
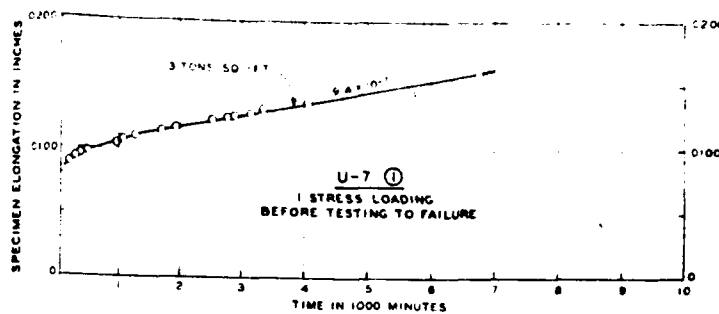
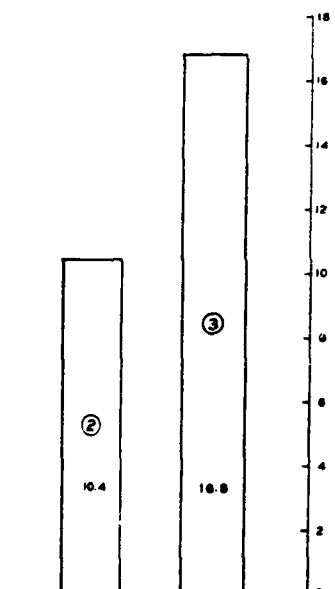
THIS DRAWING HAS BEEN APPROVED BY
TUBES-1100755 TON ORIGINAL SCALE



TYPICAL TENSILE SPECIMEN FAILURE

LEGEND:

- ① LOADED TO 1.3 TONS SQ. FT. FOR $5\frac{1}{2}$ DAYS THEN QUICK TESTED TO FAILURE
- ② LOADED TO 2.1 TONS SQ. FT. FOR 3 DAYS THEN QUICK TESTED TO FAILURE
- ③ LOADED TO 1.9 TONS SQ. FT. FOR 7 DAYS; 3.2 TONS SQ. FT. FOR 6 DAYS; 4.9 TONS SQ. FT. 7 DAYS THEN QUICK TESTED TO FAILURE



SPECIAL TESTS
SEE LEGEND

THIS DRAWING HAS BEEN REPRODUCED TO
TABLET-PRODUCED THE ORIGINAL SCALE.

THIS PLAN ASSUMES CONTRACT NO.
DA-33-600-40



U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA	
DESIGNED BY: H. A.	REVISIONS
DRAWN BY: S. A.	
CHECKED BY: J. P. Smith	
APPROVED BY: J. P. Smith	
MISSOURI RIVER FORT PECK DAM AND RESERVOIR SPILLWAY REHABILITATION SUMMARY OF RESULTS TENSILE TESTS	
DATE: SEPT 1960	BY: J. P. Smith
SCALE: 1/4" = 1'-0"	BY: J. P. Smith

2

DATE
FILMED
28